spikelets are paired on second-order branches, with these branches unilaterally disposed in relation to the first-order ones; the second-order branches are appressed or divergent from the axis of first-order branches, and there is variation in the length of the second-order branches, which gives the inflorescence a more or less lax appearance.

SPIKELET

The spikelet in section *Laxa* has the typical structure of the Paniceae, with two glumes and two anthecia, the lower one with a lemma and with or without a palea, the flower present or absent, being male when present; the upper anthecium is hermaphrodite, with a lemma and palea enclosing it. Internodes of the rachilla are inconspicuous between glumes, lower and upper flower.

The spikelets are biconvex, the lower glume reaching ⅓ to ¾ the length of the spikelet, 1–3-nerved; the upper glume and lower lemma are subequal, or the upper glume is slightly shorter and not covering the apex of the upper anthecium, 5(–7)-nerved; the lower palea may be conspicuous and either the same length as the lower lemma, or reduced to completely absent; the lower flower is occasionally present, with two lodicules and three stamens, but is usually absent; the upper anthecium encloses a perfect flower, with two cuneiform, conduplicate lodicules, which embrace the lower borders of the palea; the caryopsis has a punctiform to oblong hilum, with the embryo reaching ⅓ to ½ the length of the caryopsis.

The lower lemma is commonly membranous but occasionally indurate at maturity in specimens of *P. polygonatum*, e.g., *Idrobo & Cuatrecasas 2665*, and *P. laxum*, e.g., *Cuatrecasas & Llanos 24054*. Bisexual flowers occur in the lower anthecium of specimens of *P. stevensianum*, with two lodicules, three stamens and a conspicuous gynoecium, with two styles and a plumose stigma; in this case there is no variation in the consistency of the lower lemma, it being similar to the upper glume; no caryopsis was found in these bisexual lower flowers. The presence of bisexual flowers in the lower anthecium of *Panicum* was previously reported by Palacios (1968), Pohl (1980), and Zuloaga & Sendulsky (1988).

Three-flowered spikelets were occasionally observed in specimens of *P. grumosum*, e.g., *Quarín et al. 2745* and *Millán 568*, with anthecium I neuter, while anthecium II and upper anthecium were bisexual, the two latter with the lemma and palea indurate.

UPPER ANTHECIUM TEXTURE AND ORNAMENTATION (FIG. 1)

The epidermis of the lemma and palea has rectangular long cells arranged in longitudinal rows, with longitudinal and transverse anticlinal walls strongly undulated. Stomata, simple papillae, prickle hairs, and silica bodies are present in species of this section.

The presence of stomata is variable among the different species, being located, when present, toward the apex of the lemma and palea.

Simple papillae are regularly distributed in longitudinal rows. They are associated with the periclinal, external wall of the long cells, eccentric, and near the anticlinal transversal distal wall.

Prickle hairs are frequent toward the apex of the lemma and palea, being retrorse in *P. bresolinii*, *P. polygonatum*, and *P. pilosum*, antrorse in *P. stagnatile*, *P. longum*, *P. laxum*, and *P. hylaeicum* Mez, or with both dispositions in *P. grumosum*, *P. stevensianum*, and *P. leptachne*.

Silica bodies are exfoliate, more or less cross-shaped to nodular.

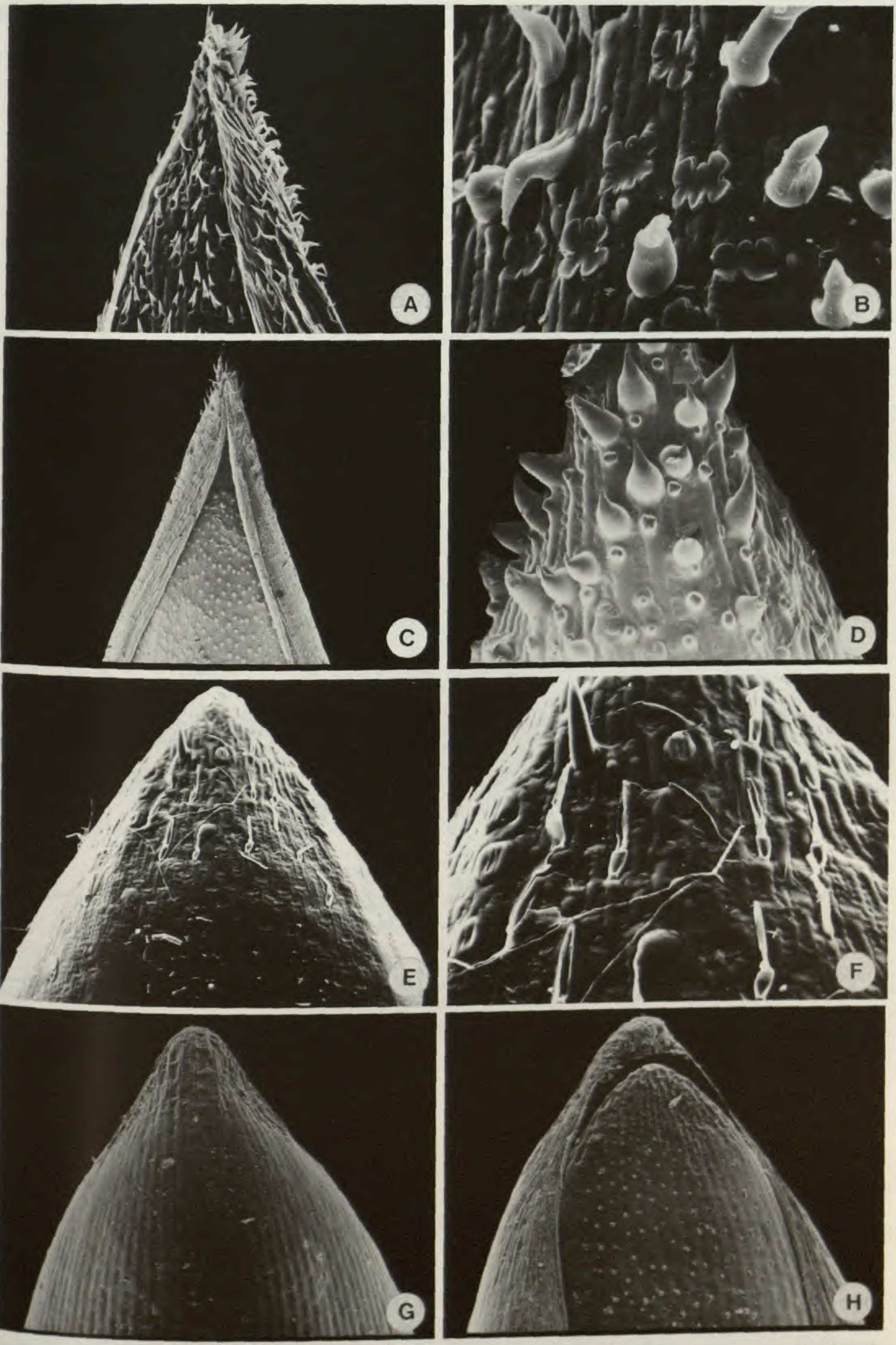
The upper anthecium varies from membranous at maturity, in such species as *P. grumosum*, *P. pernambucense*, *P. bresolinii* L. B. Smith & Wasshausen, *P. leptachne*, *P. longum*, *P. condensatum*, *P. stevensianum*, and *P. stagnatile*, to more or less indurate in *P. polygonatum*, *P. laxum*, *P. hylaeicum*, and *P. pilosum*.

Anthecial ornamentation varies in relation to the texture of the anthecium, with simple papillae, prickle hairs, and silica bodies abundant in species with membranous anthecia. In the rest of the species with indurate upper anthecia, such as *P. polygonatum*, *P. pilosum*, *P. hylaeicum*, and *P. laxum*, stomata, simple papillae, and prickle hairs are only present toward the apex, and silica bodies are occasionally present at the tip of the lemma.

Verrucose papillae, similar to the ones found in

→

FIGURE 1. Scanning electron photomicrographs of female florets of species of *Panicum*.—A. *Panicum longum*, ×100 (from type specimen).—B. *Panicum grumosum*, ×500 (*Smith & Klein 15723*). C, D. *Panicum auritum*.—C. Upper portion, ×50.—D. Tip of the lemma, ×250 (*Merrill 101*). E, F. *Panicum grande*.—E. Dorsal side, ×100.—F. Upper portion of the lemma, ×250 (*Black 15352*). G, H. *Panicum scabridum*.—G. Dorsal side, ×100.—H. Ventral side, ×100 (*Wurdack & Adderley 42986*).


A
B
C
D
E
F
G
H

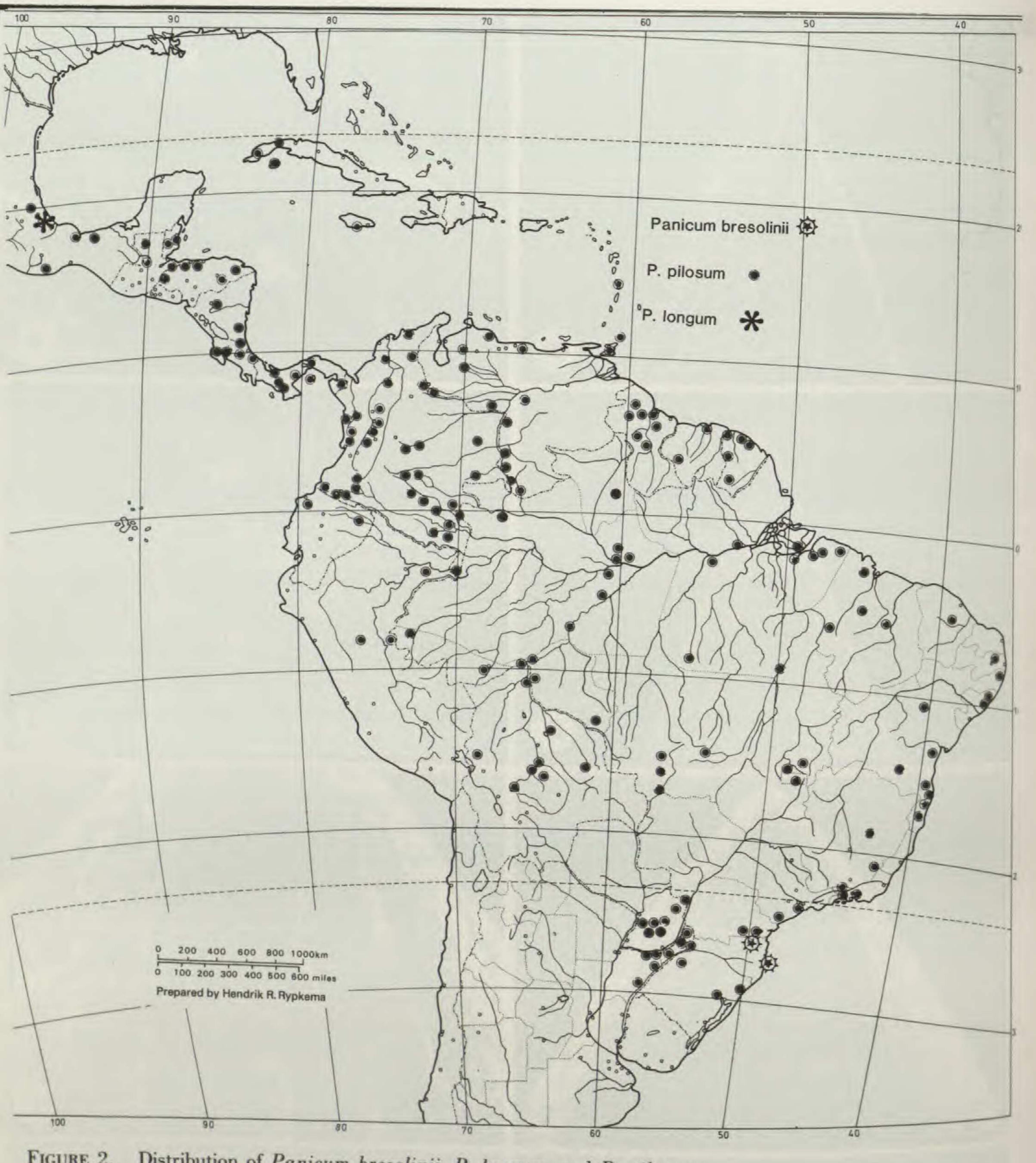


FIGURE 2. Distribution of *Panicum bresolinii*, *P. longum*, and *P. pilosum*.

species of subgenus *Steinchisma*, are sometimes present in specimens of *P. laxum*.

CHROMOSOME NUMBERS

There are few karyological studies on taxa belonging to section *Laxa*, with data of the cytology of only six species being available. A basic chromosome number of $x = 10$ characterizes the section. *Panicum auritum:* $n = 15$ (Mehra, 1982); $2n = 30$ (Christopher & Abraham, 1976; Mehra & Chaudhary, 1981; Mehra, 1982); $2n = 36$ (Mehra & Chaudhary, 1976, 1981). *Panicum grumosum:* $2n = 40$ (Núñez, 1952). *Panicum hylaeicum:* $2n = 40$ (Bouton et al., 1981). *Panicum laxum:* $n = 20$ (Davidse & Pohl, 1972b, 1974, 1978); $2n = 36$ (Gould & Soderstrom, 1967; Tateoka, 1962); $2n = 40$ (Pohl & Davidse, 1971; Gould & Soderstrom, 1967). *Panicum pilosum:* $n = 10$ (Davidse & Pohl, 1972a, 1974, 1978); $2n = 20$ (Pohl & Davidse, 1971, under *P. milleflorum*). *Panicum pernambucense:* $2n = 40$ (Bouton et al., 1981, under *P. rivulare*). *Pan-*

FIGURE 3. Distribution of *P. grumosum*, *P. hylaeicum*, and *P. polygonatum*.

icum polygonatum: $2n = 40$ (Pohl & Davidse, 1971, under *P. boliviense* Hackel; Pohl & Davidse, 1971).

LEAF ANATOMY (FIGS. 6–17)

The section *Laxa*, as constituted here, exhibits variable leaf blade anatomy, and two slightly different species groupings are evident. These two groups intergrade in their leaf anatomy, and the taxonomic significance of the differences between them will only become apparent once additional species of section *Laxa* are collected and fixed in the field. The anatomical description of the section will, nevertheless, only be based on the following species: *Panicum hylaeicum*, *P. laxum*, *P. pilosum*, *P. bresolinii*, *P. longum*, *P. leptachne*, *P. stagnatile*, *P. stevensianum*, *P. auritum*, *P. condensatum*, and *P. polygonatum*. These species constitute a homogeneous anatomical group in which the leaf anatomy is remarkably uniform, as illustrated in Figures 8–11, 13–16. For convenience,

FIGURE 4. Distribution of *P. laxum* and *P. leptachne*.

this will be called the Laxa species group. The anatomy of *P. grumosum* and *P. pernambucense* will be treated separately, as their anatomy differs somewhat from that of the Laxa group (Figs. 7, 12). This will be informally called the Grumosum species group.

LEAF BLADE IN TRANSVERSE SECTION

Outline: expanded, either flat or very broadly V-shaped; the arms of the lamina either straight or outwardly bowed; the two halves often not symmetrical on either side of the median vb, with one half being slightly wider, with more vbs; this asymmetry not pronounced being due to an extra 1′vb with an additional 3′vb between successive 1′vbs in one half of lamina; this can result in a maximum of an extra 20 vbs in one half out of a total of 52 (up to 99 in some specimens of *P. hylaeicum*) in the entire section. Thickness at mid-lamina 150–230 μm. *Ribs and furrows:* rounded adaxial ribs always present over all vbs; all ribs of similar size and shape; size of ribs differs between specimens; adjacent ribs separated by wide, open furrows; depth

FIGURE 5. Distribution of *P. pernambucense*, *P. stagnatile*, *P. stevensianum*, and *P. condensatum*.

varies from very shallow to medium furrows on different specimens of all species. Slight abaxial ribs usually distinguishable; vary from slight undulations associated with the vbs to ribs the same size as the adaxial ribs, resulting in a ± moniliform outline. *Keel:* always present, but size and amount of associated colorless parenchyma variable; varies from a simple median vb with small amount of adaxial colorless parenchyma to well-developed V-shaped keel incorporating 5 vbs, including 3 1′vbs; the vbs all abaxially located; no lacunae; this structure abruptly separated from the lamina by bulliform cell groups; this type of keel differs considerably from that present in the Grumosum group of this section, where the keel intergrades with the lamina. *Vascular bundle arrangement:* (8–)9–13(–18) 1′vbs in entire blade, usually with an additional 1′vb in one half of lamina; 3, 4, 5, or 6 3′vbs between consecutive 1′vbs; this number differs by one in each half of the lamina; no 2′vbs. All vbs centrally located in the blade thickness, although 3′vbs may be slightly abaxially displaced. *Vascular bundle description:* 3′vbs angular with xylem and phloem distinguishable, 1′vbs circular

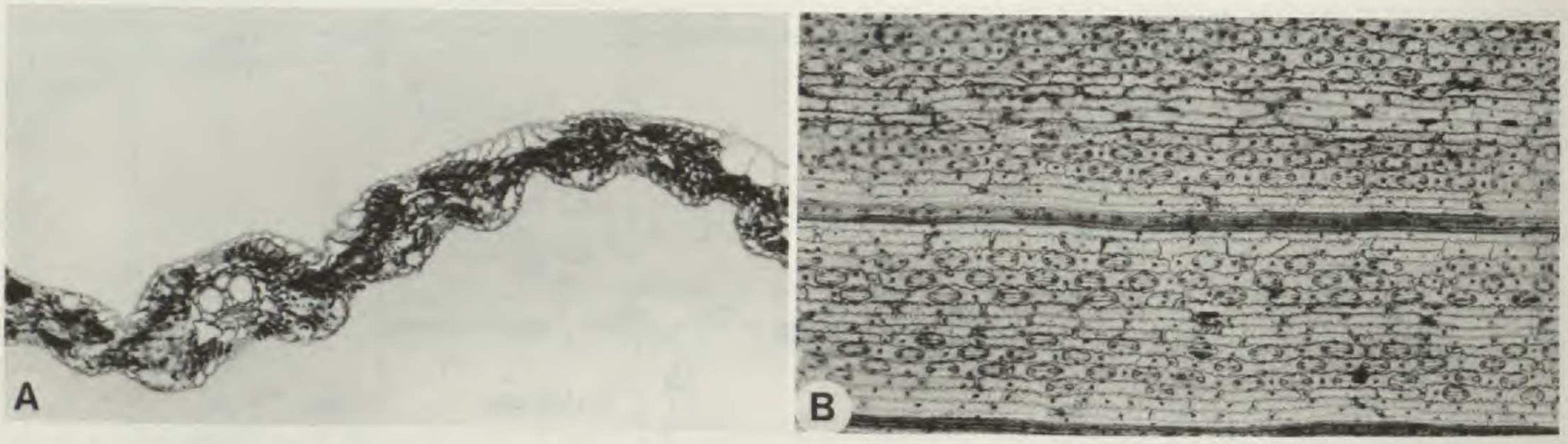


FIGURE 6. Leaf blade anatomy of *P. condensatum*.—A. Transverse section of poorly reconstituted herbarium specimen; fusoid cells and pallisadelike adaxial chlorenchyma are present.—B. Abaxial epidermis with narrow costal zones with dumbbell silica bodies and the intercostal zones clearly divided into lateral stomatal bands, and central files without stomata but with microhairs; epidermal cells nucleate (×250, based on *Davidse et al. 11494*).

to slightly elliptical in outline; phloem adjoins the ibs; lysigenous cavities and protoxylem present; circular metaxylem vessels narrower than the obs cells as seen in section. *Vascular bundle sheaths:* obs of 3′vbs conspicuous, entire, round, without extensions, although an additional adaxial cell is sometimes evident, consisting of 5 or 6 inflated, rounded cells, but up to 8 in some specimens of *P. hylaeicum*, *P. auritum*, *P. stevensianum*, *P. stagnatile*, and *P. bresolinii*, especially toward the midnerve; adaxial cells tend to be largest; chloroplast presence and type variable: either absent, or rarely, relatively small, centripetal specialized chloroplasts occur with few, small plastids; ibs absent. Obs of 1′vbs round or slightly elliptical, with slight abaxial interruption, without extensions, comprised of 8–11 cells; cells smaller than those of 3′vbs, inflated, rounded, usually all similar in shape, but extreme abaxial cells tend to be smallest. Chloroplasts as in obs of 3′vbs. Ibs present, complete, of small cells with uniformly thickened walls. *Sclerenchyma:* minute, inconspicuous adaxial and abaxial girders associated with all vbs; fibers lignified, secondary thickening variable. Small sclerenchyma cap in margin. *Mesophyll:* chlorenchyma not radiate but adaxial cells tend to a pallisade-type of arrangement; these cells tabular whereas the abaxially located chlorenchyma cells are very irregular in shape; more than 8 chlorenchyma cells between consecutive vbs; the cells, particularly those located abaxially, with definite invaginations of the walls, resembling arm cells very closely. Fusoid cells present in mesophyll: elongate, narrow, and inclined downward and present on either side of each vb. Very little reduction evident except near the margin where the lateral fusoid cells may be absent. No colorless cells. *Adaxial epidermal cells:* bulliform cells present in adaxial furrows between all vbs; in restricted groups, generally with a large, fan-shaped, inflated central cell or cells; occupy up to ½ leaf thickness. Epidermal cells small, regular in size, with a distinct continuous cuticle; no macrohairs, prickles, or papillae. *Abaxial epidermal cells:* no bulliform cells; thickened cuticle, no epidermal projections.

ABAXIAL EPIDERMIS IN SURFACE VIEW

Intercostal long cells: elongated, up to 3× longer than wide; parallel side walls; vertical or angled end walls; unthickened, moderately undulating anticlinal walls; this sinuosity conspicuous. Cell shape consistent across intercostal zones except that interstomatal long cells are shorter, long cells in a file either adjoin one another or are separated by short cells—either a single tall and narrow cell or cork-silica cell pairs. Conspicuous nuclei usually present in intercostal long and short cells. *Stomata:* low dome-shaped or ovoid but may tend to low triangular; subsidiary cells with conspicuous nucleus often contained within a slight evagination at the apex. Common with 6–10 files of stomata per intercostal zone, with only the 3–6 central long cell files without stomata—these cells more elongate than the interstomatals and may stain less intensely. Stomatal rows in adjoining files of cells; usually one interstomatal cell between successive stomata in a file but this arrangement variable. Stomata files separated from the costal files by 1–2 intercostal files without stomata. *Intercostal short cells:* either absent, on solitary and tall and narrow or paired with both cork and silica cells and tall and narrow. Distribution irregular, but most common in central files of intercostal zones. *Papillae:* absent except in single specimen of *P. stevensianum* (*Chase 6616*). *Prickle hairs:* absent except for small intercostal hooks on one specimen of *P. pilosum* (*Davidse 21866*). Small angular prickles with short barbs present on the leaf margin. *Microhairs:* elongated, fingerlike, with distal and basal

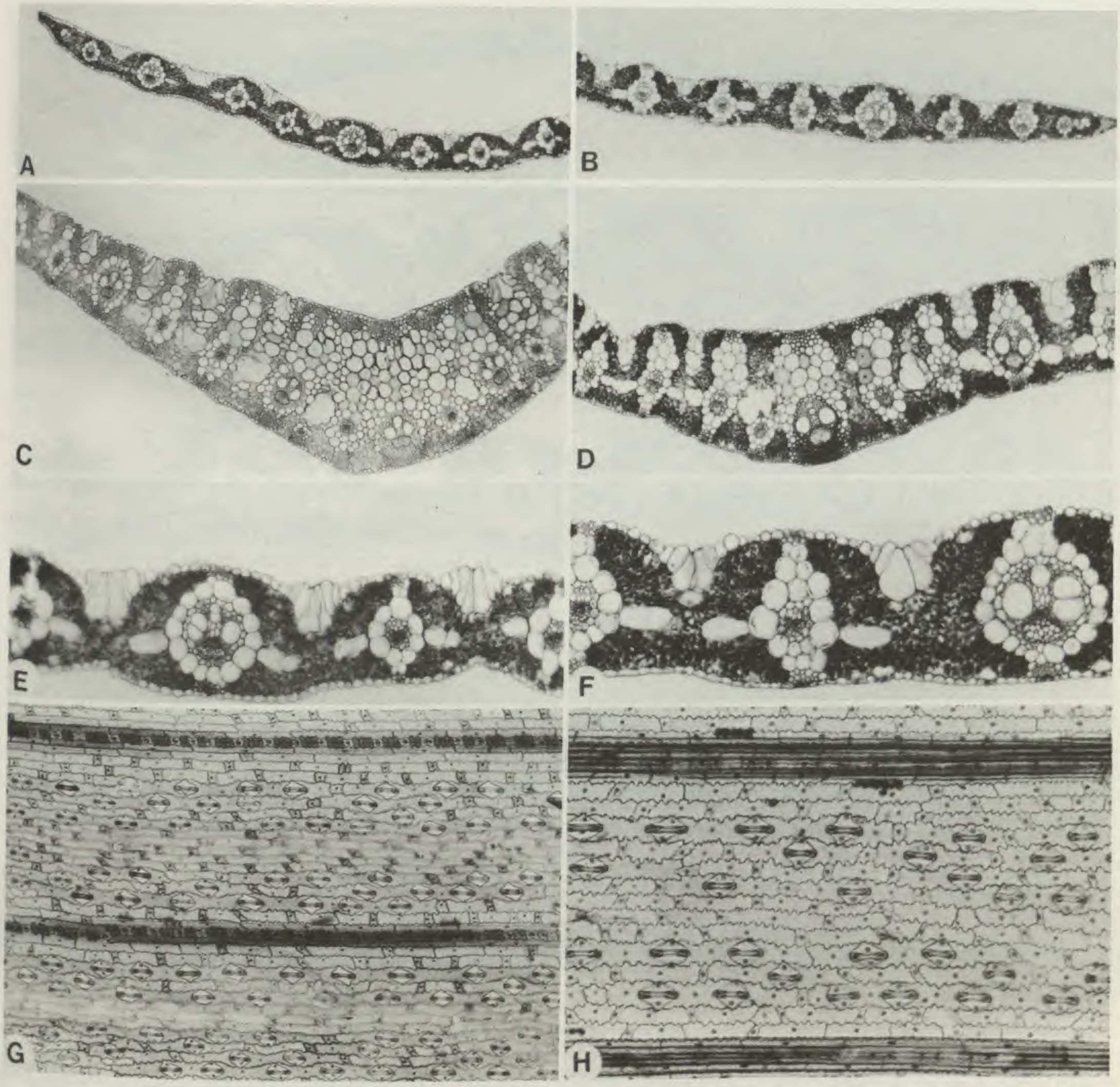


FIGURE 7. Leaf blade anatomy of *Panicum grumosum*. A–F, transectional anatomy.—A. Gently tapering leaf blade margin; note rather irregular occurrence of fusoid cells near margin.—B. Slightly acute margin with small sclerenchyma cap; fusoid not associated with three most lateral bundles and presence irregular, with other bundles situated near the margin.—C. Keel consisting of many vascular bundles (more than 12), all with adaxial bundle sheath extensions and gradually intergrading into the lamina; fusoid cavities in this region of the leaf resemble lacunae, as only a single cavity is present in the mesophyll between successive bundles.—D. Specimen in which keel is less developed but incorporates at least seven bundles; note lacunae intergrading laterally into typical fusoid cavities.—E. Detail of mesophyll at mid-lamina; note regular occurrence of fusoids and much shorter bundle sheath extensions than nearer the center of the blade.—F. Irregular occurrence of fusoid cells and extension of the outer bundle sheaths of the third-order vascular bundles in particular. G, H. Abaxial epidermal structure.—G. Nucleate intercostal long and short cells and narrow costal zones with irregularly dumbbell-shaped silica bodies; central files in intercostal zones without stomata.—H. Detail of nucleate intercostal long, short, and triangular subsidiary cells (A, E, based on *Zuloaga 3087*; B, D, F, H, *Zuloaga s.n.*; C, G, *Zuloaga 3073*; A–D ×50; E–G ×125; H ×200).

cells of equal length; distal cell deciduous with very thin walls; common in the center of the intercostal zones. *Macro-hairs:* absent except for new cushion-based hairs on single specimen of *P. pilosum* (*Davidse 21866*). *Silica bodies:* vertically elongated dumbbell- or cross-shaped, or equidimensional dumbbell-shaped to elongated nodular (more rarely and only overlying the 3′vbs). Alternate regularly with similar shaped or shorter costal short cells along central costal file; only 3 (rarely 5) files of cells per costal zone. Each costal zone therefore only has a single file of cells with silica bodies bounded on either side by a file of costal long cells.

This description is based only on the anatomy

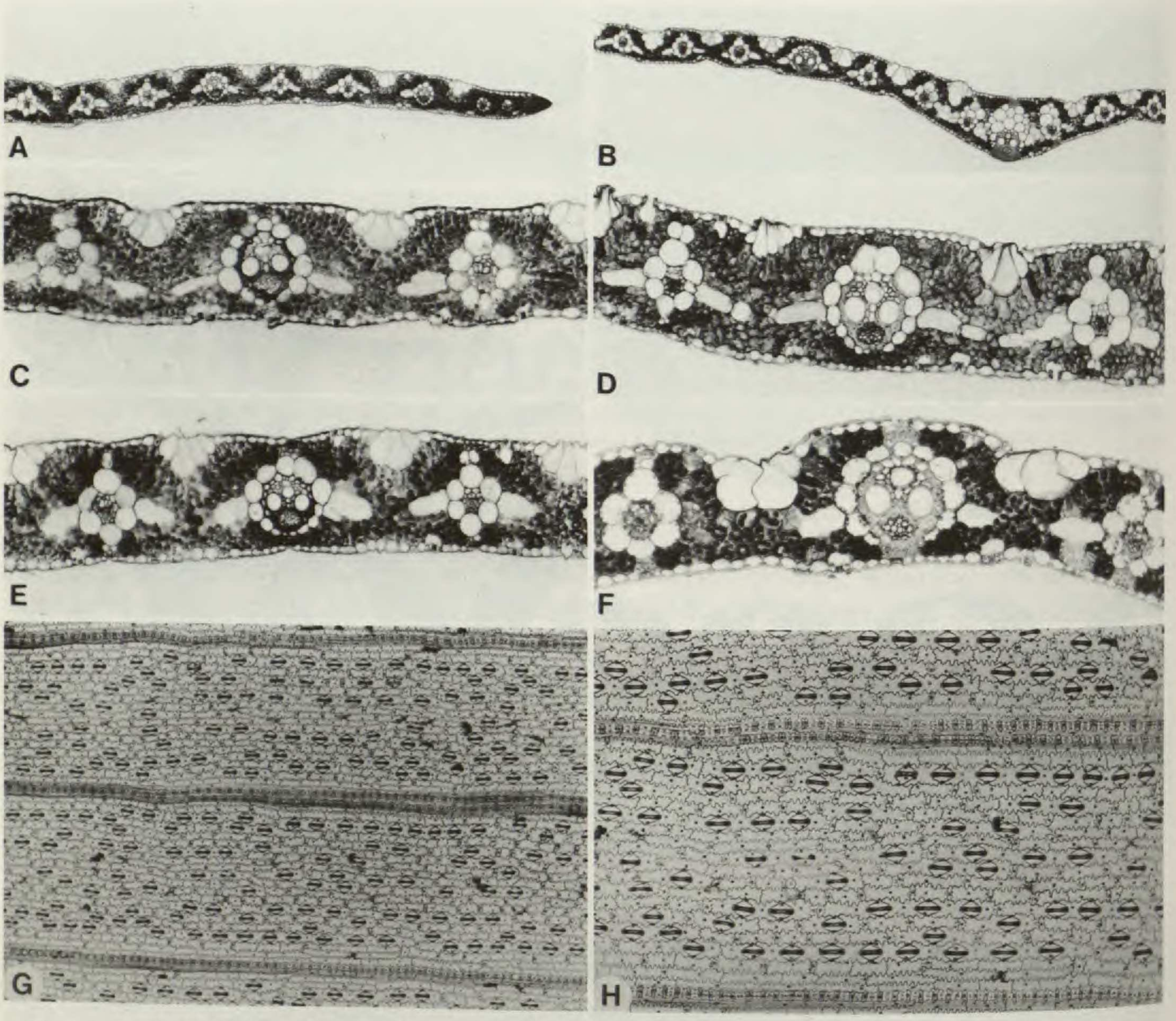


FIGURE 8. Leaf blade anatomy of *Panicum hylaeicum*. A–F, transectional anatomy.—A. Lateral part of lamina showing tapering margin with small cap of sclerenchyma; note regular presence of fusoid cells associated with all vascular bundles except for penultimate and ultimate lateral bundles in the margin.—B. Restricted keel comprising three vascular bundles; adaxial parenchyma developed in association with median first-order vascular bundle and adjacent third-order bundle on either side with bundle sheath extensions; regular fusoid cells not associated with these bundles.—C. Outer bundle sheath cells without chloroplasts, fusoids narrow and inclined toward the abaxial surface, adaxial chlorenchyma with pallisade arrangement.—D. Detail of arm cell-like chlorenchyma cells, particularly those located abaxially and adjacent to the fusoid cells; note the fusoid cavities appear to be bounded by the thin walls of the fusoid cells.—E. Regular occurrence of a fusoid cell on either side of most vascular bundles.—F. Specimen with small, unspecialized chloroplasts in the outer bundle sheath cells. G, H. Abaxial epidermis.—G. Narrow costal zones (3–5 files wide) and wide intercostal zones (16–19 files wide).—H. Low triangular stomata in files throughout intercostal zones, in all horizontal cell files, but tend to be less concentrated in the central files of the zones; subsidiary and intercostal long cells with characteristic persistent nuclei; note irregular dumbbell-shaped costal silica bodies alternating with similar shaped cork cells along costal cells files (A, B, E, F, *Zuloaga et al. 2293*; C, *Zuloaga 2218*; D, G, H, *Zuloaga 3197*; A, B × 50; G ×80; C–F, H ×125).

of the Laxa species group, *P. hylaeicum*, *P. laxum*, *P. pilosum*, and *P. polygonatum*, as well as *P. leptachne*, *P. longum*, *P. condensatum*, *P. auritum*, *P. stagnatile*, *P. stevensianum*, and *P. bresolinii*. The Grumosum group, *P. grumosum* and *P. pernambucense*, differs in several respects: *lamina width* generally wider, although *P. hylaeicum*, *P. stagnatile*, and *P. leptachne* sometimes have blades as wide as those of *P. grumosum*, a maximum of 105 vbs versus 52 in the Laxa group (although up to 99 can occur in *P. hylaeicum*); asymmetry less marked (48 versus 57 vbs); *thickness* at mid-lamina generally greater; *keel* well developed, incorporating 7–12 vbs (1–5 in Laxa group), wide and expanded and intergrading into the lamina (not abrupt as in Laxa group); *lacunae* present in the colorless parenchyma of the keel (absent in Laxa group); *metaxylem vessel*

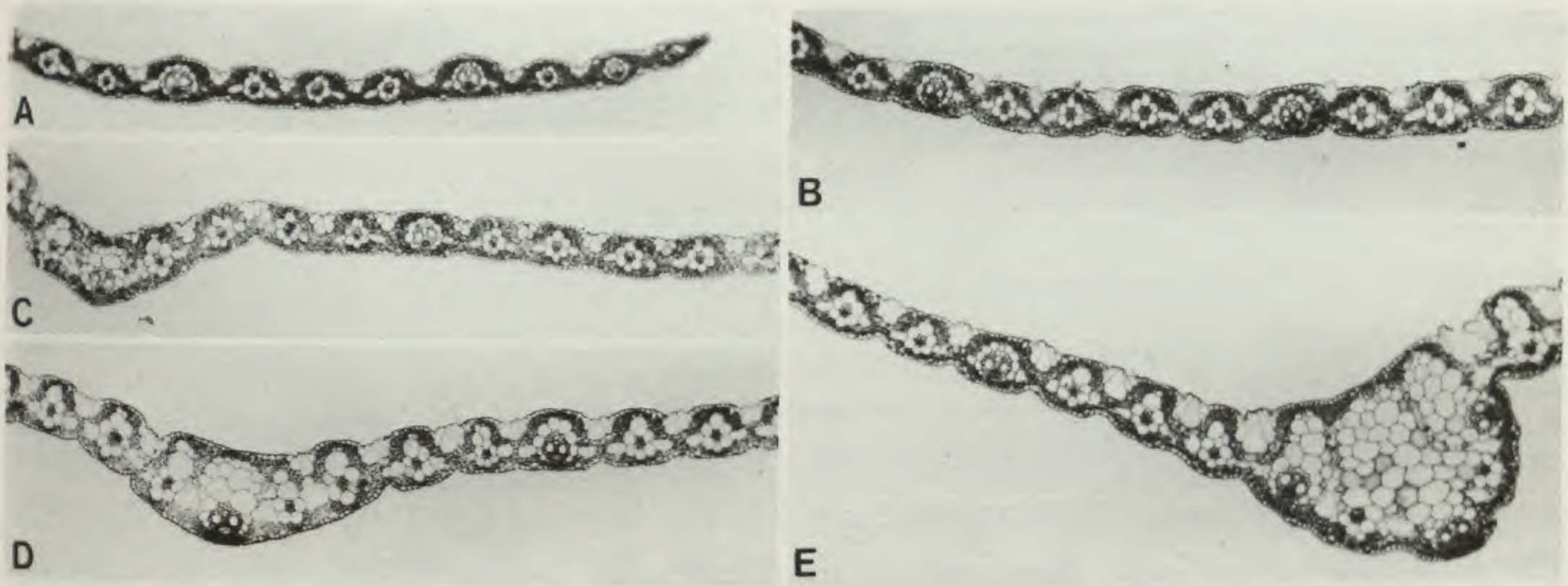


FIGURE 9. Transectional anatomy of the leaf blade outline of *Panicum laxum*.—A. Gently tapering margin with only the most laterally situated vascular bundles without associated fusoid cells.—B. Mid-lamina region showing four third-order vascular bundles located between successive first-order bundles; note fusoid cavities on either side of all bundles. C–E. Variation in the structure of the keel.—C. Insignificant keel incorporating only the median vascular bundle; this first-order bundle with small amount of adaxial colorless cell tissue.—D. Most common intermediate keel type incorporating 3 vascular bundles and adaxial colorless tissue.—E. Unusual elaborate V-shaped keel with 5 vascular bundles and extensive colorless parenchyma; note abrupt delimitation from lamina by bulliform cell groups (A, based on *Zuloaga 3290*; B, *Stevens 25354*; C, *Zuloaga 2337*; D, *Davidse 30703*; E, *Zuloaga et al. 4330*; A–E ×50).

diameters greater than in Laxa group (often wider than obs cells); *outer bundle sheath* with 8–10 cells around 3′vbs (5–6(–8) in Laxa group); 16–20 cells in obs of 1′vbs (8–11 in Laxa group); *bundle sheath extensions* always present (variable, from 1–4 cells deep); adaxial; uniseriate to biseriate; longest extensions closer to keel; *chlorenchyma cells* smaller and more compact, adaxial cells

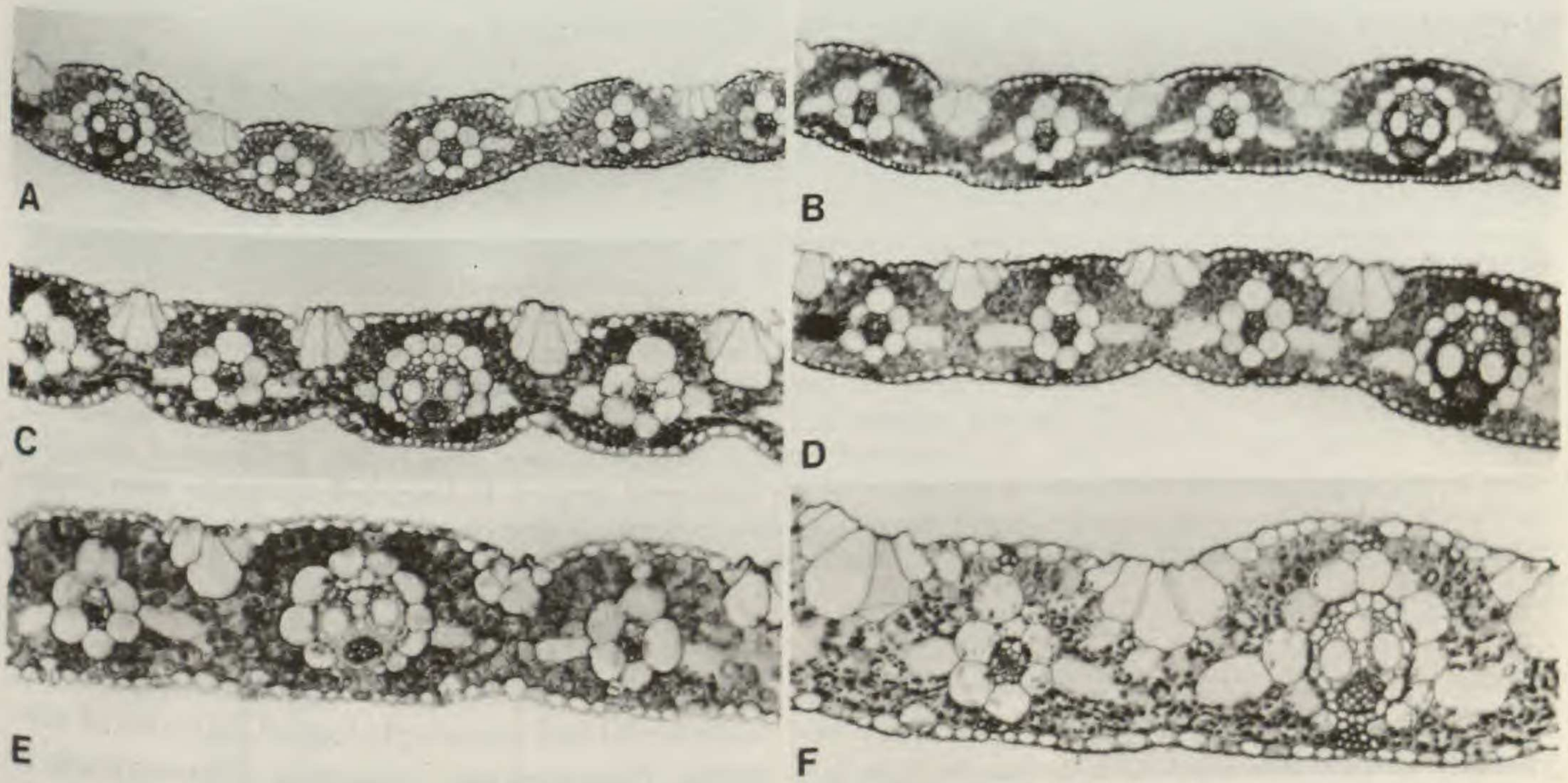


FIGURE 10. Detail of transectional leaf anatomy of *Panicum laxum*.—A. Thinner lateral part of lamina where fusoid cell occurrence is less regular; outer sheath cells without chloroplasts.—B. Specimen with typical anatomy of the Laxa group: regular fusoid cell presence and parenchyma sheath cells without chloroplasts.—C. Typical Laxa-type anatomy, but note well-developed adaxial ribs and furrows, very similar to those of *P. pilosum*.—D. Fusoid and bundle sheath cell structure.—E. Adaxial chlorenchyma tissue palisadelike, particularly above the fusoid cavities, whereas the abaxial chlorenchyma cells are equidimensional with discernible cell wall invaginations.—F. Specimen with anatomy tending to the intermediate C_3/C_4 type with a few, centripetally located chloroplasts, which differ structurally from those of the chlorenchyma; note the presence of fusoid cavities and that this leaf is thicker than other *P. laxum* specimens (A, based on *Stevens 25275*; B, *Zuloaga 3290*; C, *Zuloaga et al. 4330*; D, *Zuloaga et al. 4367*; E, *Zuloaga 2337*; F, *Brown 19*; A–D ×125; E, F ×200).

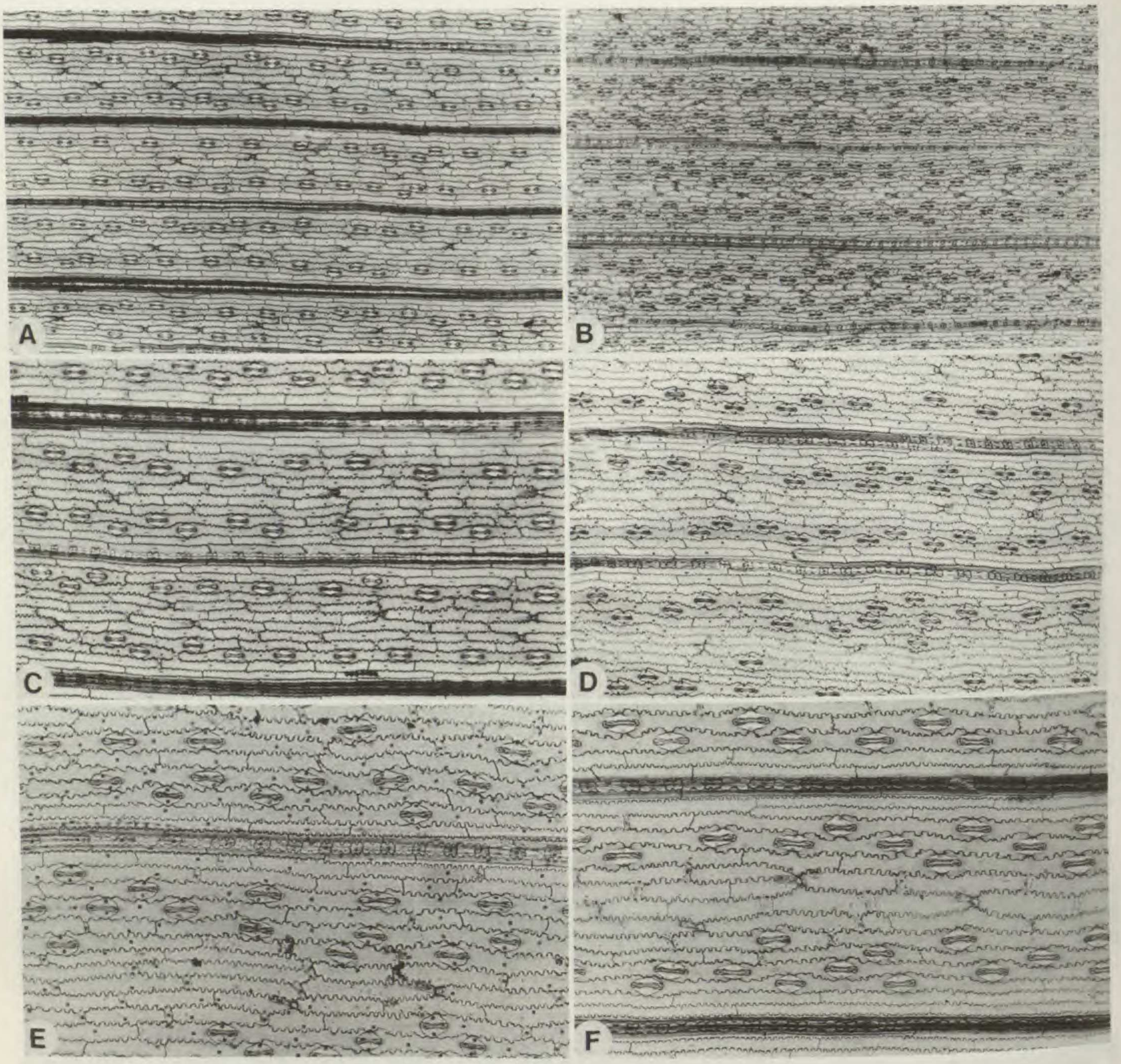


FIGURE 11. Consistent abaxial epidermis structure of *Panicum laxum*.—A. Epidermal zonation with narrow costal zones evenly spaced across lamina width.—B. Zonation with intercostal zones slightly wider than in A.—C. Narrow costal zones of 1 or 3 cell files and stomata in 1 or 2 files laterally situated in the intercostal zones.—D. Typical *P. laxum* epidermal structure.—E. Epidermal detail of dumbbell-shaped silica bodies, low dome or triangular nucleate subsidiary cells and microhairs in the center of the intercostal zones.—F. Dumbbell or nodular silica bodies, low triangular subsidiary cells and microhairs between long cells in center of intercostal zones (A, C, based on *Davidse 32998*; B, *Zuloaga 3290*; D, *Zuloaga s.n.*; E, *Zuloaga 2571*; F, *Davidse 30703*; A, B ×80; C, D ×125; E, F ×200).

without pallisade arrangement; *fusoid cells* irregular in occurrence, particularly laterally; may be virtually absent (*Zuloaga 3232*); fuse to form lacunae in keel; *intercostal long cells* short, generally less than 3× longer than wide; interstomatal cells often very short.

DISCUSSION

The possible affinities of section *Laxa* with other sections of *Panicum* and other genera of the Paniceae are summarized in Table 1.

Section *Laxa* conforms within *Panicum* to the anatomical and exomorphological diagnosis of subgenus *Phanopyrum*. Subgenus *Phanopyrum* is characterized anatomically by the presence of a double bundle sheath, the inner mestome sheath with thick-walled cells and the outer sheath parenchymatous, with slightly thickened walls, and completely devoid of, or with few, nonspecialized chloroplasts (Zuloaga, 1987). The number of mesophyll cells between the vascular bundles varies between 5 and 12, and the mesophyll tissue is irregularly arranged; this is typical of non-Kranz anatomy. All

TABLE 1. Comparison of section *Laxa* with other sections of *Panicum*, *P. grande*, and genera *Homolepis* and *Hymenachne*.

	Genus *Panicum*						
	Genus *Homolepis*	Subg. *Steinchisma* sect. *Steinchisma*	Subg. *Phanopyrum* sect. *Laxa*		Subg. *Phanopyrum* *P. grande*	Subg. *Phanopyrum* sect. *Phanopyrum*	Genus *Hymenachne*
			Group Laxa	Group Grumosum			
Photosynthetic type	C_3 (rarely C_3/C_4 intermediate)	C_3/C_4 intermediate	C_3 (rarely C_3/C_4 intermediate)	C_3	C_3	C_3	C_3
Fusoid cells present	+ (absent in *H. longispicula*)	−	+	+ (sometimes reduced)	−	−	−
Lacunae present	−	−	−	Present in keel only	Present in keel and mesophyll	Present in keel and mesophyll	Present in keel and mesophyll
Superposed bundles present	−	−	−	−	+	+	−
Upper anthecium consistency	Indurate	Indurate	Indurate to membranous	Membranous	Indurate	Indurate	Membranous
Palea covered at its apex by the lemma	+	+	+	+	+	+	−
Prickle hairs and papillae present	−	−	+	+	−	−	+
Inflorescence with unilateral branches	−	−	+	+	−	+	+
Lower palea expanded; compound papillae present	−	+	− (rarely present in *P. laxum*)	−	−	−	−

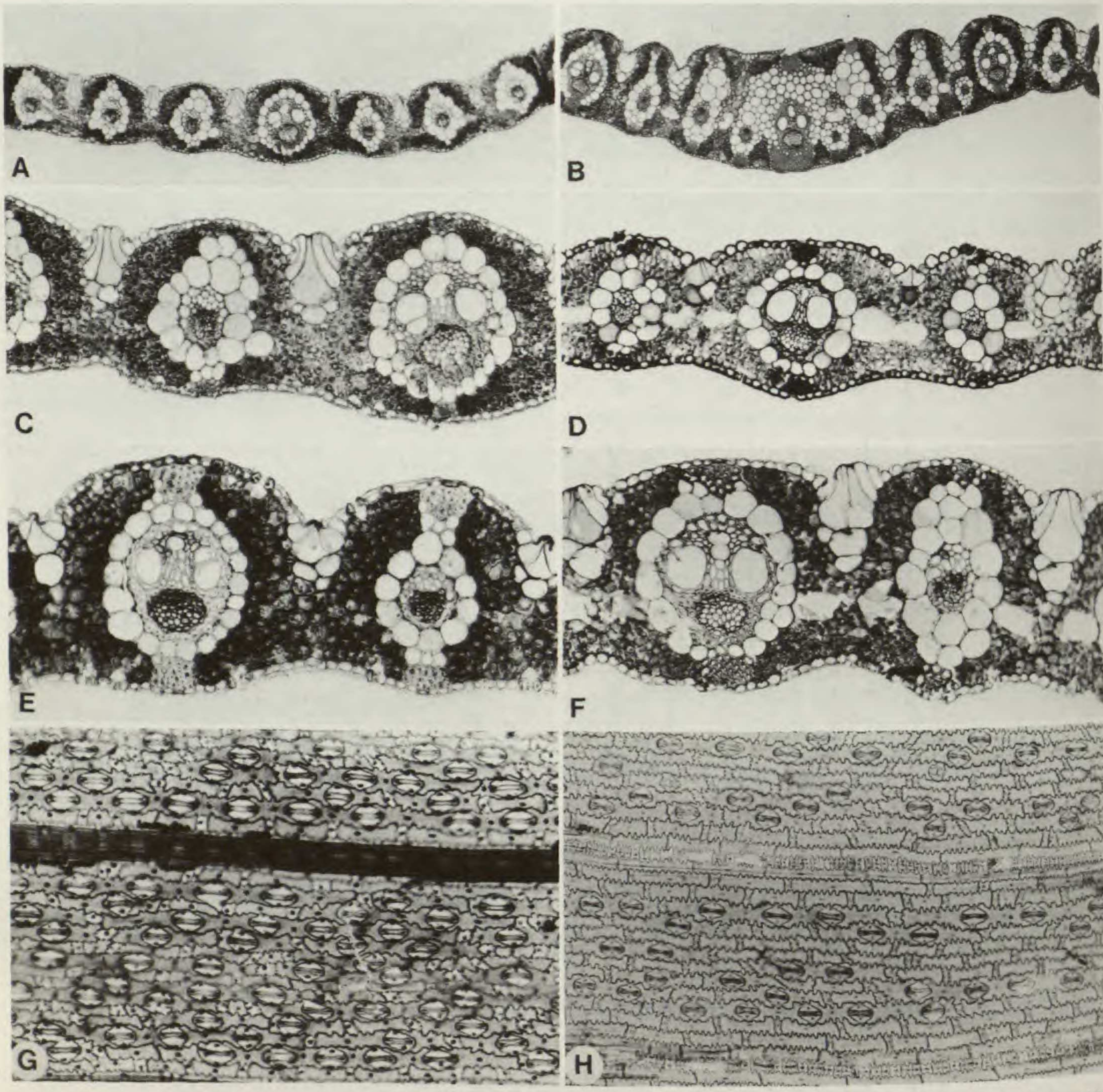


FIGURE 12. Leaf blade anatomy of *Panicum pernambucense*. A–F. Transectional anatomy.—A. Mid-lamina with first- and third-order bundles; note absence of fusoid cavities.—B. Keel with five bundles gradually intergrading with lamina; few lacunae present.—C. Anatomical detail showing virtual absence of fusoids and short adaxial bundle sheath extensions associated with the third-order bundles.—D. Specimen with irregular fusoid cell presence.—E. Detail of compact mesophyll without palisadelike tissue; no fusoid cells.—F. Irregular fusoid occurrence and compact mesophyll of arm cells. G, H. Abaxial epidermal structure.—G. Thickened long cell walls with stomata regularly distributed throughout intercostal zone; note nucleate nature of all intercostal cells.—H. All cells shorter than in Laxa type, particularly the intercostal long cells and the silica bodies (A, C, based on *Zuloaga et al. 3232*; B, E, G, *Zuloaga 2235*; D, *Zuloaga et al. 3323*; F, H, *Zuloaga 2494*; A, B ×50; G, H ×200; C–F ×125).

taxa in this subgenus possess the C_3 photosynthetic pathway. Plants of subgenus *Phanopyrum* are commonly found in humid and shady habitats and have membranous, small ligules; the inflorescences vary in this subgenus from spikelets disposed unilaterally in racemose branches (as in sections *Stolonifera*, *Phanopyrum*, and *Laxa*), to spikelets dispersed in lax or contracted panicles; spikelet nervation is constant, the lower glume 1–3-nerved and the upper glume and lower lemma 5-nerved, occasionally 7-nerved (Zuloaga, 1987). Zuloaga (1987) suggested two subgroups could be distinguished in subgenus *Phanopyrum*: one with a basic chromosome number of $x = 10$, spikelets disposed unilaterally on the branches, and upper anthecium smooth, without papillae and bicellular microhairs, which includes sections *Phanopyrum*, *Laxa*, and *Stolonifera*; the other one with $x = 9$, spikelets in open or contracted panicles, not unilaterally disposed, and upper anthecium papillate and with

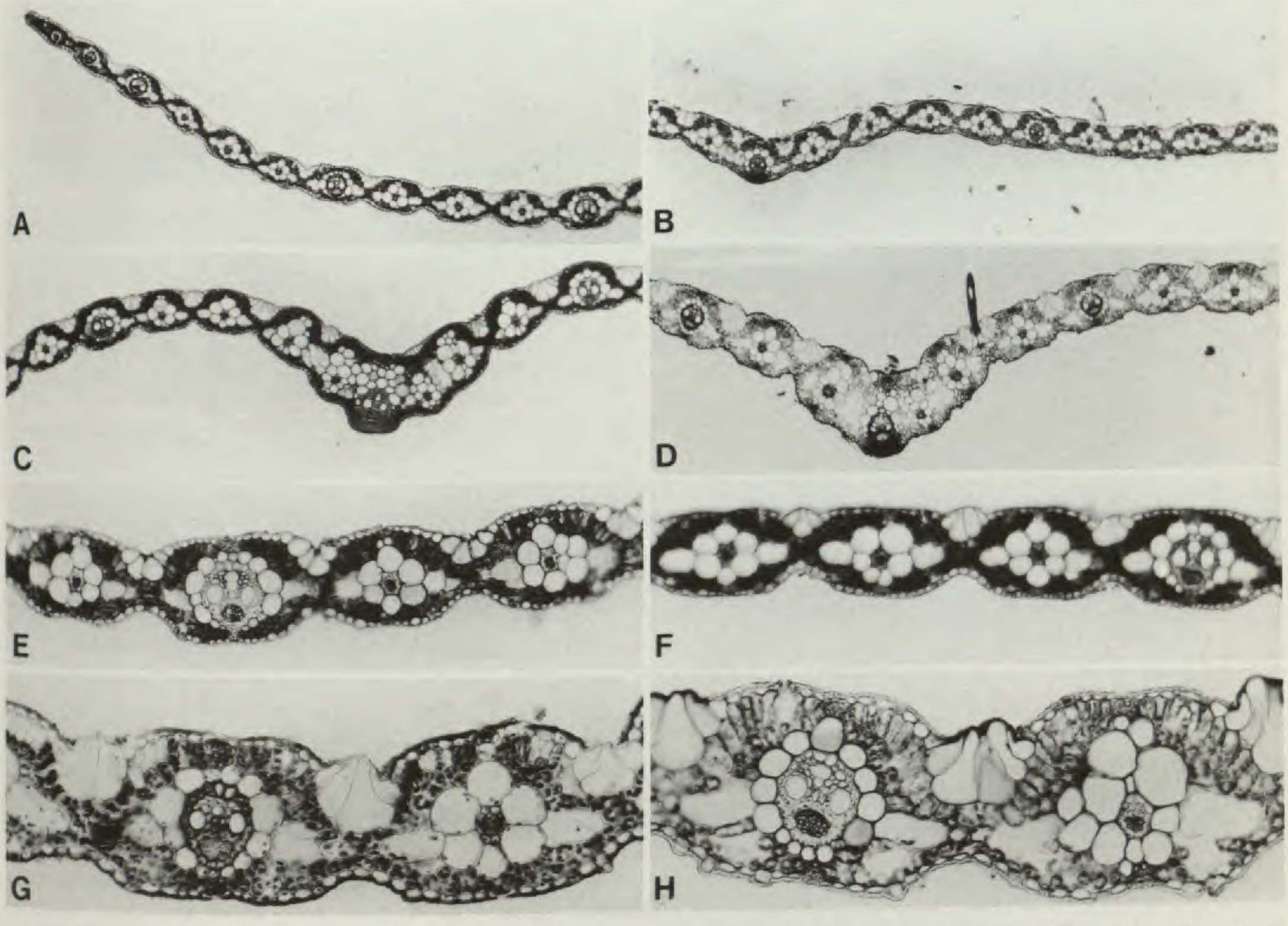


FIGURE 13. *Panicum pilosum* leaf blade in transverse section.—A. Margin showing fusoids associated with all vascular bundles except the most lateral ones. B–D. Structure of keel.—B. Median vascular bundle only, without associated colorless cell development.—C. Typical keel including three vascular bundles and with colorless parenchyma; median bundle with additional sclerenchyma girder development.—D. Typical keel but note lacunae in keel; unusual adaxial macrohair base evident.—E. Typical Laxa anatomy with palisadelike mesophyll, regular fusoid cell presence and parenchyma sheath cells without chloroplasts; presence of abaxial ribs and furrows characteristic.—F. Note that abaxial ribs and furrows larger than those of adaxial surface.—G. Few chloroplasts in outer sheath cells; note thick cuticle with evidence of abaxial epidermal hooks.—H. Typical palisade adaxial chlorenchyma; note breakdown of fusoid cavities to form lacunae (A, E, based on *Zuloaga 3289*; B, G, *Stevens 25219*; C, F, *Zuloaga 2303*; D, H, *Davidse 21866*; A–D ×50; E, F ×125; G, H ×200).

bicellular microhairs, with sections *Parviglumia*, *Parvifolia*, *Monticola*, and *Verrucosa* within this group. Section *Lorea*, originally placed by Zuloaga (1987) in this second group, is more closely related to the first one, with a similar upper anthecium ornamentation and a basic chromosome number of $x = 10$, although spikelets are scattered on the panicles.

Section *Laxa* is distinct from the other sections of *Phanopyrum* as well as from sections of *Dichanthelium*, the other C_3 subgenus, in that all representatives possess translucent fusoid cells in the mesophyll. The presence of these fusoidlike cells in section *Laxa* has been reported by Killeen & Clark (1986), who suggest that their presence lends support to Brown's (1977) revised evolutionary scheme for the Paniceae based on leaf anatomy and photosynthetic pathway. Fusoid cells in species of section *Laxa* are illustrated for *P. hylaeicum* (as *P. boliviense*) (Brown et al., 1985) and *P. pernambucense* (= *P. rivulare*) (Morgan & Brown, 1979; Wilson et al., 1983).

Fusoid cells are a distinguishing feature of the Bambusoideae and the peripheral bambusoid groups (Ellis, 1987) but have also been recorded in *Homolepis* (Watson et al., 1985) and *Streptostachys* (Clayton & Renvoize, 1986), in addition to section *Laxa* (Killeen & Clark, 1986). In all these non-bambusoid, panicoid taxa, the fusoid cavities are seen to be cellular in paradermal section, the cells being inflated and not constricted and girderlike as in most of the Bambusoideae. These structures therefore conform to the definition of fusoid cells and are not to be confused with lacunae, which are noncellular cavities in the mesophyll and which also occur in the Grumosum group of section *Laxa*.

Fusoid cells are, therefore, diagnostic for section *Laxa* within *Panicum* but are not restricted to

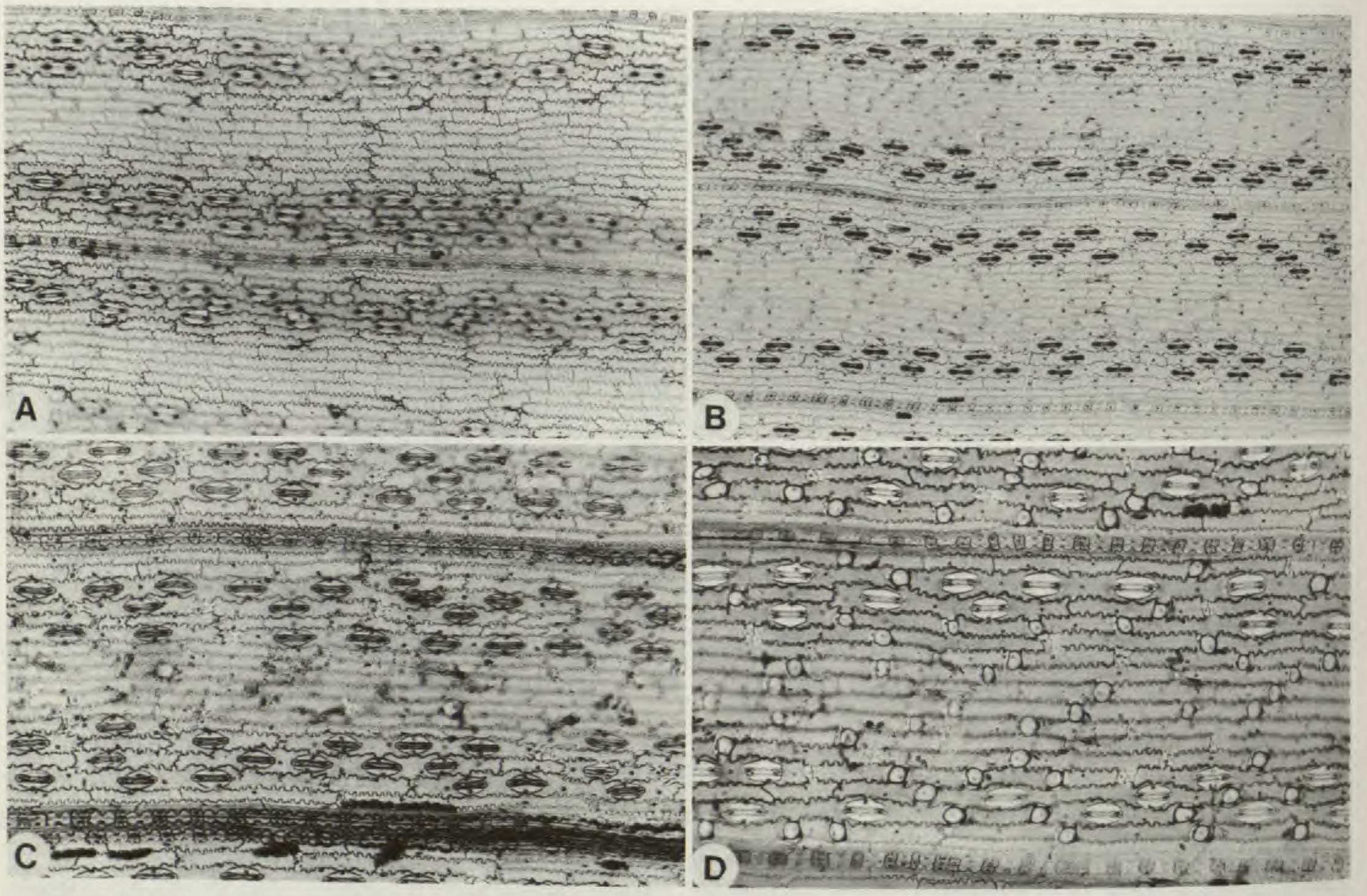


FIGURE 14. Abaxial epidermis of *Panicum pilosum*.—A. Typical zonation with wide intercostal zones; note differential staining of stomata files and central files of intercostal zones.—B. Narrow costal zones and clear stomatal bands.—C. Detail of dumbbell-shaped silica bodies and low triangular stomata; note microhairs and few hooks in center of intercostal zone.—D. Epidermis resembling *Homolepis glutinosa* with numerous small intercostal hooks (A, based on *Zuloaga et al. 4513*; B, *Zuloaga 3289*; C, *Zuloaga 2303*; D, *Davidse 21866*; A, B ×125; C, D ×200).

these taxa in the Paniceae, as they also occur in *Homolepis* and *Streptostachys*. The leaf anatomy of *Homolepis aturensis* (Kunth) Chase, *H. glutinosa* (Sw.) Zuloaga & Soderstrom, *H. isocalycia* (Meyer) Chase, and *H. villaricensis* (Mez) Zuloaga & Soderstrom, but not *H. longispicula* (Doell) Chase, closely resembles that of the Laxa group of section *Laxa* in most other respects as well. The only discernible anatomical difference between the Laxa group and *Homolepis* is that *Homolepis glutinosa*, in particular, often has numerous intercostal hooks, and macrohairs are sometimes present. These features, although rare, are not unknown in section *Laxa* and were observed on a specimen of *Panicum pilosum* (*Davidse 21866*), which is indistinguishable from most specimens of *H. glutinosa* on the basis of leaf anatomy.

Although the anatomy of section *Laxa* and *Homolepis* is similar, the exomorphological evidence does not suggest close affinities between these two taxa. In *Homolepis* spikelets are arranged in open, lax panicles; the lower glume reaches the same length and has the same nervation as the upper glume; the lower lemma has conspicuous bi- or tricellular secretory microhairs, which contain a resin that is secreted when the spikelets mature; the upper anthecium in *Homolepis* is covered with dumbbell-shaped silica bodies, bicellular microhairs toward the apex, and it lacks simple, evenly distributed papillae; and the hilum is linear, reaching one half to the entire length of the caryopsis.

Fusoid cells are also present in the leaf blades of the Grumosum group of section *Laxa*, although in these species they may be absent, particularly near the margin. In some specimens this reduction is extensive, with most vascular bundles without associated fusoid cells (Fig. 12A, C, E). Specimens of *P. pernambucense* in which the fusoid cells are rare or absent closely resemble those of *P. rude* Nees, of section *Stolonifera*, and *P. mertensii* Roth, of section *Megista*, in transectional leaf anatomy. The epidermal structure is also similar, and this may indicate affinity. *Panicum rude* has a similar mesophyll to species of the Laxa group, the adaxial cells tending to a pallisade-type of arrangement, with 6–8 cells in 3′vbs; metaxylem vessels are narrower than the obs cells as seen in cross section. *Panicum mertensii* has a similar mesophyll to that of *P. rude* and 6(–8) cells in 3′vbs. The keel is similar to that of *P. grumosum*. *Panicum rude*,

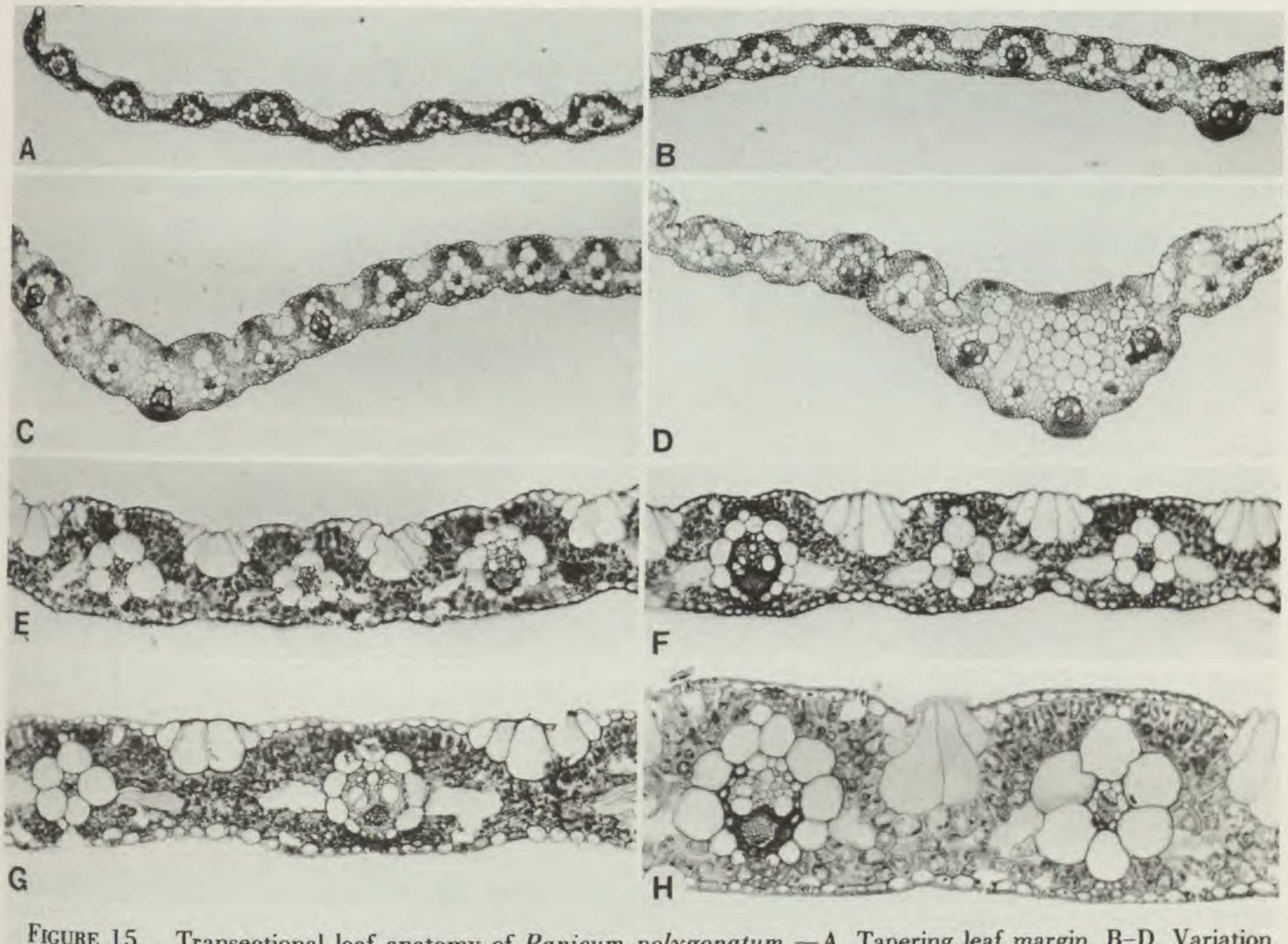


FIGURE 15. Transectional leaf anatomy of *Panicum polygonatum*.—A. Tapering leaf margin. B–D. Variation in structure of keel.—B. Keel with three vascular bundles; note that third-order bundles on either side of median bundle have additional colorless parenchyma cells associated with the outer bundle sheath.—C. Typical Laxa-type keel incorporating three vascular bundles.—D. Large keel of 3 first-order and 2 third-order vascular bundles and colorless parenchyma tissue.—E. Detail of parenchyma sheath cells with few, very small chloroplasts.—F. Conspicuous fusoid cavities present on either side of all vascular bundles.—G. Typical Laxa-type anatomy.—H. Detail of palisadelike adaxial chlorenchyma, fusoid cavities and parenchyma sheath cells devoid of chloroplasts (A, E, based on *Zuloaga 3913*; B, F, *Davidse 30413*; C, *Davidse 26917*; D, *Zuloaga & Londoño 4238*; G, *Stevens 25879*; H, *Davidse 21844*; A–D ×50; E–G ×125; H ×200).

together with other species of section *Stolonifera*, shares with section *Laxa* a similar inflorescence type and basic chromosome number. Section *Stolonifera* is differentiated by its stipitate, smooth, and glabrous upper anthecium and lower lemma with or without crateriform glands on the middle portion (Zuloaga & Sendulsky, 1988). Section *Megista* differs from section *Laxa* by the inflorescence type and spikelet outline and nervation, with branches of the inflorescence whorled and spikelets obovate, globose, with the upper glume and lower lemma 7–9-nerved (Zuloaga, 1987). Species of sections *Laxa*, *Stolonifera*, and *Megista* share a similar humid habitat, which may explain this superficial similarity in leaf anatomy.

Lacunae occur in the Grumosum group of section *Laxa* in the same location as fusoid cells in the mesophyll between the vascular bundles (Figs. 7D, 12D, F). Lacunae consist of a single lysigenous cavity between successive vascular bundles as seen in transection (and not two inflated cells as in fusoids) and are not cellular. In *P. grumosum* and *P. pernambucense* these lacunae are often only associated with the keel and intergrade into normal fusoid cavities in the mid-lamina.

The Grumosum group resembles *Hymenachne* rather closely on the basis of the lacunae, as well as leaf anatomy in general, a trend that is not shared by the Laxa group of species. This relationship between *Hymenachne* and species of section *Laxa* was emphasized by Zuloaga & Soderstrom (1985), who suggested that species of *Laxa* could be congeneric with *Hymenachne*. These authors pointed out that *Hymenachne* differs from *Panicum* by having the upper palea free at its apex. Pohl & Lersten (1975) considered that the presence of aerenchyma is a good character to separate *Hymenachne* from related genera, such as *Sacciolepis* and *Panicum*. Species of *Laxa*, including the Grumosum group, have the upper

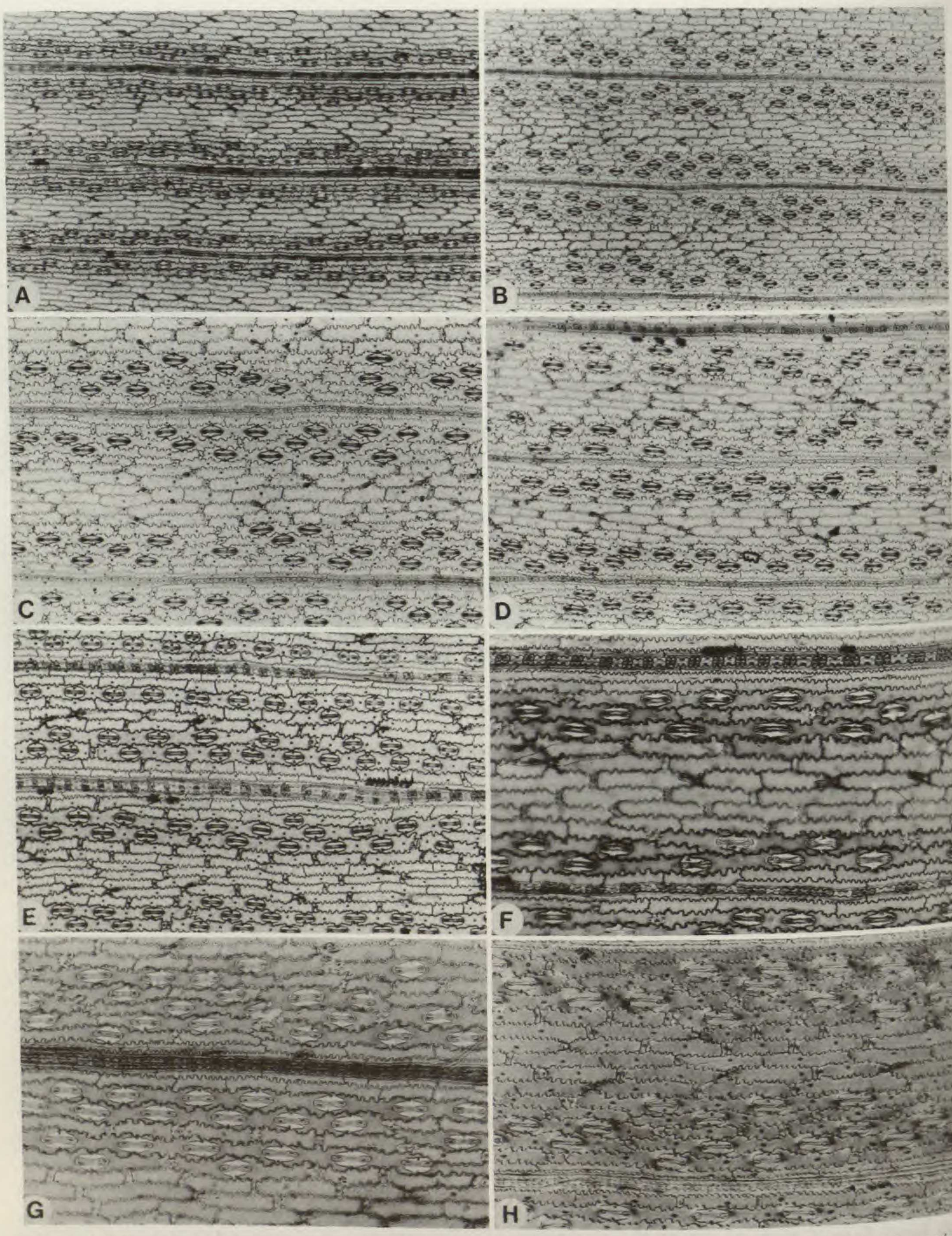


FIGURE 16. Typical Laxa-type abaxial epidermal structure of *Panicum polygonatum*.—A. Epidermal zonation with regularly spaced, narrow costal zones; note absence of stomata in center of intercostal zones.—B. Abaxial cellular pattern.—C. Costal zones 3 cell files wide, sinuous intercostal long cells and stomatal bands adjacent to the costal zones.—D. Typical Laxa-type abaxial epidermal structure.—E. Short dumbbell- to cross-shaped silica bodies alternating with darkly staining but similar shaped cork cells; stomata low dome-shaped; note that most epidermal cells have persistent nuclei.—F. Detail of dumbbell and nodular silica bodies and evaginations of subsidiary cells; note microhairs in center of intercostal zone.—G. Typical Laxa epidermal cellular structure and pattern; note differential staining of center of intercostal zone (without stomata) as compared to the stomatal files.—H. Interference contrast illumination showing nuclei in all long cells, short cells, and subsidiary cells; microhairs visible in center of intercostal zone (A, F, based on *Davidse 30413*; B, C, *Zuloaga 4087*; D, *Zuloaga 3913*; E, *Stevens 25879*; F, *Davidse 21844*; G, *Davidse 26917*; A, B ×80; C–E ×125; F–H ×200).

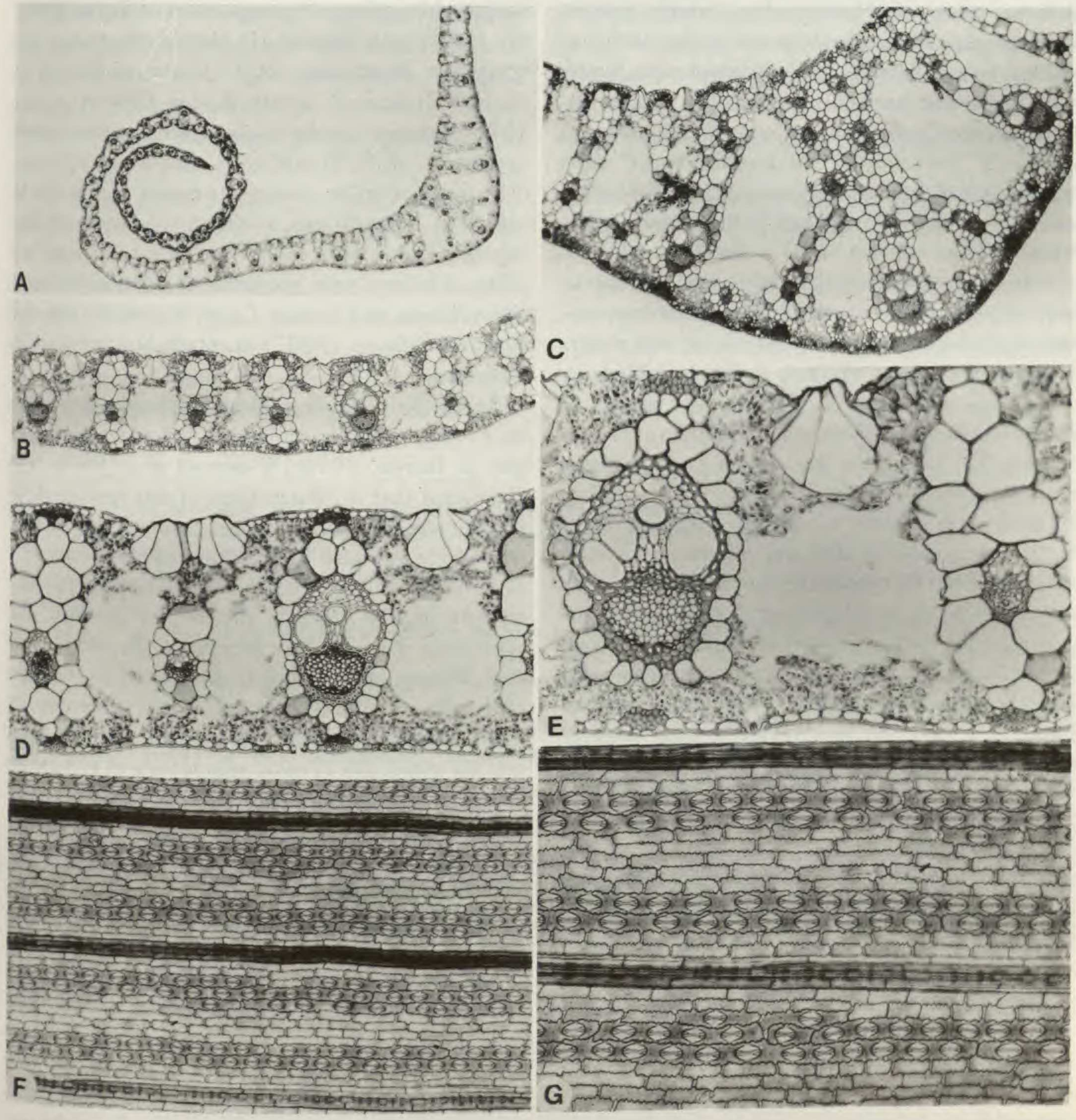


FIGURE 17. Atypical leaf blade anatomy of *Panicum grande*. A–E. Leaf anatomy as seen in transverse section.—A. Outline of blade as seen in cross section showing continuously decreasing thickness from median vascular bundle to margin.—B. Mid-lamina, showing arrangement of vascular bundles (3 third-order bundles between successive first-order bundles) and the presence of a single lacunal cavity in the mesophyll between all bundles.—C. Keel structure showing gradual integration into lamina, definite lacunae and the superposed vascular bundles located away from the abaxial surface.—D. Outer bundle sheath cells without chloroplasts and wide adaxial extensions present, particularly on the sheaths of smaller bundles.—E. Detail of bundles, sheaths, and mesophyll; note that the lacunae are not bounded by cell walls but are just cavities in the chlorenchyma. F, G. Abaxial epidermis.—F. Epidermal zonation with stomata clearly grouped into 2–3 files of cells on either side of 4–5 files of long cells located in the center of the intercostal zones.—G. Detail of relatively short long cells, particularly the interstomatals; all intercostal cells nucleate, although these rather indistinct (A–G, based on *Davidse 21867*; A ×125; B, C ×50; F ×80; D, G ×125; E ×200).

palea covered at the apex by the lemma and lack stellate aerenchyma in culms, sheaths, and blades; they can also be separated by the presence of fusoid cells, although this can be controversial if reduction, or their replacement by lacunae has occurred. However, it could be argued that there has been a correlation with the presence of fusoid cells, upper anthecia consistency, and habitat in these taxa. Species of drier habitats, usually found on edges of woods, have indurate upper anthecia with fewer silica bodies and papillae, are less robust, have conspicuous fusoid cells, and lack lacunae in transverse section of the blade. By contrast, species such as *P. grumosum* and *P. pernambucense*, as

well as those of *Hymenachne*, which inhabit streambanks, have membranous upper anthecia and leaves with lacunae and less conspicuous fusoid cells. There are, however, intermediate species between groups Grumosum and Laxa of section *Laxa*, such as *P. bresolinii*, *P. stagnatile*, and *P. leptachne*, which have membranous upper anthecia, conspicuous fusoid cells and lack lacunae in the leaves. There appears to be a developmental sequence from fusoid cavities through lacunae to aerenchyma: these structures may be ontogenetically homologous or merely correlated with shady, wet tropical habitats (Killeen & Clark, 1986).

Lacunae also occur in the keel and lamina of *P. gymnocarpon* Elliott, section *Phanopyrum*, a species that resembles the section *Laxa* in some respects of leaf anatomy. However, the keel differs from the one present in species of section *Laxa* by its superposed bundles and conspicuous lysigenous cavities. The midnerve has conspicuous pith aerenchyma, as is common in *Hymenachne amplexicaulis*. Taking into consideration the superposed bundles, pith aerenchyma, and conspicuous lacunae, this species seems to be more closely related to *P. grande* and *Hymenachne*. Alternatively, the presence of lacunae in these taxa may represent a convergence or similar adaptation to an aquatic habitat.

Subgenus *Steinchisma* is characterized by possessing an intermediate C_3–C_4 photosynthetic pathway in which the anatomy is Kranz but with fewer centripetal chloroplasts in the outer bundle sheath cells than is usual. The vascular bundles are also farther apart than in normal Kranz sections, with 5 to 7 chlorenchyma cells between bundles (Zuloaga, 1987). Fusoid cells are absent in all species of this subgenus. Physiologically these species are intermediate between C_3 and typical C_4 plants (Brown & Brown, 1975; Morgan & Brown, 1979; Brown et al., 1985) but all have carbon isotope ratios in the C_3 range. Exomorphologically, species of *Steinchisma* can be distinguished by open panicles, with spikelets not unilaterally disposed, lower palea expanded at maturity, and upper anthecium covered by verrucose papillae.

Section *Laxa* generally has typical C_3 leaf anatomy with very few or no chloroplasts in the outer bundle sheath cells. However, in a few specimens of *P. laxum* specialized chloroplasts are present in these cells, and the anatomy tends toward the C_3/C_4 intermediate type. Examples are *Stevens 25354*, *Zuloaga et al. 4330* and, in particular, *Brown 19* (Fig. 10F), which closely resembles *P. decipiens* Nees ex Trin. and *P. spathellosum* Doell, of subgenus *Steinchisma*, in the structure of the bundle sheath chloroplasts. A comparison of Figure 8 (Ellis, 1988) with Figure 10 clearly illustrates this similarity. Illustrations of *P. laxum* in Wilson et al. (1983) and *P. spathellosum* (Brown et al., 1985) support this observation. We have examined specimens of *P. laxum* with characters intermediate in relation to the ones present in species of subgenus *Steinchisma*, such as palea more or less expanded and upper anthecium with verrucose papillae. All these data confirm the relation between *Steinchisma* and section *Laxa*, supporting the decision of Zuloaga (1987) to retain *Steinchisma* in *Panicum*.

In all the physiological and hybridization work on *P. laxum* that has included leaf anatomy (Morgan & Brown, 1979; Wilson et al., 1983), it is significant that no illustrations of this species show fusoid cells. This is in marked contrast to the findings of the present study where all 14 accessions of *P. laxum* had conspicuous fusoid cavities present on both sides of virtually all vascular bundles. The specimens illustrated by Morgan & Brown (1979) and Wilson et al. (1983) also have C_3/C_4-type chloroplasts, and it is possible that their results were based on incorrect identifications or at least are not applicable to most populations of *P. laxum*. However, *P. laxum* leaf blade material received from R. H. Brown did have fusoid as well as C_3/C_4-type anatomy (Fig. 10F), which appears to confirm their determination.

The decision to recognize two informal anatomical species groups in section *Laxa* for the purpose of the anatomical description appears to be supported by this discussion of character distributions and possible affinities. Thus, the Laxa group shows links to *Homolepis* on the basis of fusoid cells and such characters as keel structure, but not morphological characters, and even to *Steinchisma*, on the basis of the photosynthetic anatomy and the keel structure. Similarly, the Grumosum group tends toward *Hymenachne* and other taxa in subgenus *Phanopyrum* because of similar reduction of fusoid cells and presence of lacunae, C_3 anatomy, and the possession of wide keels with lacunae.

Taxonomic Treatment

Panicum section **Laxa** (A. Hitchc. & Chase) Pilger. Notizbl. Bot. Gart. Berlin-Dahlem 104(11): 243. 1931. *Panicum* Group *Laxa* A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 110. 1910 (invalid name); A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 17(6): 201. 1915.
TYPE SPECIES: *Panicum laxum* Sw.

Inflorescences with lax to contracted panicles, with spikelets ± crowded and unilaterally disposed on the branches or in short branchlets. *Spikelets* pilose or glabrous, elliptic to lanceolate. *Lower glume* ⅓ to ¾ the length of the spikelet, 1–3-nerved. *Upper glume and lower lemma* subequal or the upper glume shorter and not covering the upper anthecium. *Lower palea* conspicuous, with the same length of the lower lemma, to small or absent; lower flower present and male, occasionally bisexual, or absent. *Upper anthecium* membranous to indurate, papillose, with simple papillae all over its surface or toward the apex and with prickle hairs at the apex of lemma and palea; silica bodies present in the membranous anthecia, palea covered by the lemma at its apex; upper flower bisexual, lodicules 2, conduplicate; stamens 3, styles 2, stigma plumose. *Blades* lanceolate to ovate-lanceolate. *Ligules* membranous, with or without short hairs at the distal portion.

Plants perennial, usually growing in wet places at edges of woods or margins of ponds, streams or rivers.

Non-Kranz anatomy, basic chromosome number $x = 10$.

Section with 12 American species, growing from Mexico to Argentina, and with one Asiatic species.

KEY TO SPECIES OF SECTION *LAXA*

1a. Spikelets on first-order branches, second-order branchlets absent, occasionally present toward the base of the inflorescence; main axis and branches usually long-pilose to scabrous.
2a. Spikelets 1.9–3.2 mm long; ligules present.
3a. Blades narrowed at base; Mexico ..... 8. *P. longum*
3b. Blades cordate at base; Brazil.
4a. Branches of inflorescences glabrous; panicles 13–24 cm long; spikelets 1.9–2.4 mm long ..... 3. *P. condensatum*
4b. Branches of inflorescences papillose-pilose; panicles 25–40 cm long; spikelets 2.1–3.2 mm long ..... 7. *P. leptachne*
2b. Spikelets 1.3–1.5 mm long; ligules usually absent, occasionally present ..... 10. *P. pilosum*
1b. Spikelets mainly on short second-order branchlets; main axis and branches scabrous to short-pilose, occasionally long-pilose.
5a. Blades amplexicaulous, cordate.
6a. Spikelets 1.4–1.7 mm long, lower palea present, the culms rigid; Mexico to Argentina ..... 5. *P. hylaeicum*
6b. Spikelets 2.1–2.3 mm long, lower palea absent, the culms herbaceous; Santa Catarina, Brazil ..... 2. *P. bresolinii*
5b. Blades not amplexicaulous, rounded to subcordate, occasionally cordate in specimens of *P. stagnatile*, *P. stevensianum*, and *P. polygonatum*.
7a. Spikelets pointed at apex, without lower flower; lower palea absent to reduced.
8a. Plants 0.15–0.50(–1) m tall; blades 4–17 cm long; panicles 8–20 cm long; spikelets 1.3–1.6 mm long ..... 11. *P. polygonatum*
8b. Plants 1–3 m tall; blades 17–60 cm long; panicles 20–40 cm long; spikelets 1.6–2.2(–3) mm long.
9a. Spikelets (2.2–)2.5–3 mm long. Asia ..... 1. *P. auritum*
9b. Spikelets 1.6–2.2(–2.5) mm long; America.
10a. Panicles slender, with spikelets not crowded on second-order branches; Mexico to Panama ..... 12. *P. stagnatile*
10b. Panicles congested, with spikelets crowded on second-order branches; northeastern Brazil to Paraguay, Uruguay, and Argentina ..... 9. *P. pernambucense*
7b. Spikelets not pointed at apex, with a male lower flower, bisexual in specimens of *P. stevensianum*, occasionally absent; lower palea present.
11a. Upper flower with two stamens, occasionally three; spikelets 1–1.7 mm long ..... 6. *P. laxum*
11b. Upper flower with three stamens; spikelets 1.9–3 mm long.
12a. Culms spreading, decumbent at the base, 0.20–1 m tall; spikelets 1.9–2.6 mm long; lower flower bisexual, occasionally male or absent; West Indies and northern South America ..... 13. *P. stevensianum*
12b. Culms erect, 1.30–2 m tall; spikelets 2.3–3 mm long; lower flower male; eastern Brazil to Argentina ..... 4. *P. grumosum*

1. **Panicum auritum** J. S. Presl ex Nees, Agrost. Bras.: 176. 1829. *Hymenachne aurita* (J. S. Presl ex Nees) Bal., Cat. Indo-China Française, Journ. de Bot. 4: 30. 1890. *Sacciolepis aurita* (J. S. Presl) A. Camus, in Lecomte, Fl. Gen. Indo-Chine 7: 459. 1922. TYPE: Philippines. "in Luzon insula" (holotype, PR? not seen; isotype, W).

Perennials, with erect *culms* 1.1–1.3 m tall, simple; internodes 5–17 cm long, terete, hollow, glabrous; nodes brownish, glabrous. *Sheaths* 4–10

cm long, shorter than the internodes, striate, glabrous, the margins membranous, ciliate or not at the upper portion. *Ligules* membranous, 0.4–1 mm long, laciniate or not, brownish. *Blades* lanceolate, 17–30 cm long, 0.8–1.6 cm wide, flat, cordate to subcordate at base, attenuate at the apex, short pilose on both surfaces to glabrous, the margins scabrous, the lower ones ciliate or not. *Inflorescence* exserted, peduncle 8–20 cm long, glabrous, smooth; panicles lax, 16–45 cm long, 3–15 cm wide; *main axis* wavy, scaberulous, pulvini pilose, with whitish hairs, to glabrous, first-order branches alternate, divergent, axis of the branches triquetrous, scabrous, spikelets short-pedicelled, appressed and paired on short second-order branchlets, pedicels triquetrous, scabrous. *Spikelets* narrowly ovate, (2.2–)2.5–3 mm long, 0.8–0.9 mm wide, glabrous, greenish and tinged with purple, upper glume and lower lemma subequal, acute, 5-nerved. *Lower glume* ovate, acute, 0.9–1.2 mm long, less than ⅓ the length of the spikelet, 3-nerved, midnerve scaberulous toward the apex. *Lower palea* elliptic, small, 1–1.4 mm long, 0.3 mm wide, hyaline, glabrous, the borders ciliolate or not; lower flower absent. *Upper anthecium* narrowly elliptic, 1.9–2.6 mm long, 0.6–0.8 mm wide, acuminate, membranous at maturity, brownish, glabrous, with simple papillae and prickles toward the apex. *Caryopsis* ovate, 1–1.3 mm long, 0.5–0.8 mm wide, brownish; hilum oblong, embryo less than ½ the length of the caryopsis.

Distribution and ecology. Found at edge of forest in humid places or in open, wet sites, from sea level to 1,200 m, in Southeast Asia, India, Sri Lanka, and southern China, in tropical Asia. It is a weed in plantations of rubber, tea, teak, and *Cinchona* (Lazarides, 1980).

Additional specimens examined. BORNEO. Sandakan and vicinity, *Ramos 1597* (P). MALAYSIA. Singapur, Park of the broadcasting Station Jureng, *Sinclair 9828* (M). PHILIPPINES. LUZON: Manila, *Merrill 101* (M, P, SI*), *238* (W); Prov. of Sorgoson, Irosin, *Elmer 14344* (P), *16398* (P, W); Prov. of Rizal, Morong, *Ramos s.n.* (W); San Francisco del Monte, *Loher 1719* (M); Luzón central, *Loher 1718* (P*). MINDANAO: Zamboanga district, Malangao, *Ramos & Edaño s.n.* (P). CEYLON [SRI LANKA]. Ratmapoora, *Thwaites 3242* (P, W). THAILAND. Khow-Yau National Park, *Larsen et al. 68* (W); Bangkok, *Kerr 7044* (P); Bangkok, Wat Lum, *Kerr 6952* (P). VIETNAM. Van-Yeu, *Balansa 4914* (P, W); Hue, Annam, *Hitchcock 19378* (P); Annam, Tourane, *Clemens 4045* (P); Tu-Phep, *Balansa 1630* (P).

Panicum auritum, the only non-American species of the section, was included in *Laxa* by Pilger (1940). It is related to *P. laxum*, differing by having spikelets pointed, with the lower palea reduced and lower flower absent.

2. P. bresolinii L. B. Smith & Wasshausen, Bradea 2(35): 245, fig. 2, A–D, 1978. TYPE: Brazil. Santa Catarina: Florianópolis, Morro Costa da Lagoa, 200 m, 19 Apr. 1967, *Klein & Bresolin 7360* (holotype, US 2536896). Figures 2, 18.

Plants of indefinite duration, probably perennials, the *culms* decumbent, rooting and branching at the lower nodes, then becoming erect, ca. 90 cm tall, internodes compressed, hollow, glabrous, nodes dark, densely pilose with whitish hairs. Leaves with *sheaths* usually shorter than the internodes, short-hirsute with stiff papillose-pilose hairs, one margin membranous, the other short-ciliate. *Ligules* small, 0.5 mm long, membranous with a short fringe of hairs at the apex. *Blades* lanceolate, 15–26 cm long, 2.2–3 cm wide, flat, shortly pseudopetiolate, pseudopetiole brownish, ca. 0.2 cm long, pilose, blades cordate at the base, amplexicaulous, acuminate, short-pilose and with long hairs toward the base on the adaxial surface, the abaxial surface glabrous with anastomosed nerves. *Inflorescence* a lax panicle 26 cm long, 10–13 cm wide; main axis wavy, scabrous, spikelets unilaterally disposed on short secondary branchlets, paired or solitary, axis of the branches, branchlets and pedicels triquetrous, scabrous, axils of the branches pilose. *Spikelets* narrowly elliptic, 2.1–2.3 mm long, 0.5–0.6 mm wide, acute, glabrous, upper glume and lower lemma subequal. *Lower glume* ovate, 1.1–1.4 mm long, ½ or more the length of the spikelet, 3-nerved, the nerves anastomosed toward the apex, the keel scabrous. *Upper glume* acute, 5-nerved, the nerves anastomosed, the keel scabrous. *Lower lemma* acute, 3-nerved, the keel scabrous. *Lower palea* absent; lower flower absent. *Upper anthecium* lanceolate, 1.7–2 mm long, 0.5 mm wide, membranous at maturity, whitish, smooth, with simple papillae and conspicuous, retrorse prickle hairs at the apex of lemma and palea, rachilla prolonged beyond the upper anthecium as a short mucro. *Caryopsis* not seen.

Distribution and ecology. Known from Santa Catarina, Brazil, where it grows in swamp forest. In flower from March to April.

Additional specimens examined. BRAZIL. SANTA CATARINA: 5 km NE of Papanduva along highway BR-116 to Curitiba, 780 m, *Davidse et al. 11056* (MO, SI*, SP).

Related to *P. hylaeicum* Mez, it differs by the spikelet size, 1.4–1.7 mm long in *P. hylaeicum*,

FIGURE 18. *Panicum bresolinii* (based on *Davidse et al. 11056*).—a. Habit, with panicle included.—b. Detail of ligule and lower portion of the blade.—c. Racemose branch.—d. Spikelet, lower glume view.—e. Spikelet, upper glume view.—f. Spikelet, lateral view.—g. Upper anthecium, lemma view.—h. Upper anthecium, palea view.—i. Upper portion of the upper lemma showing prickle hairs.

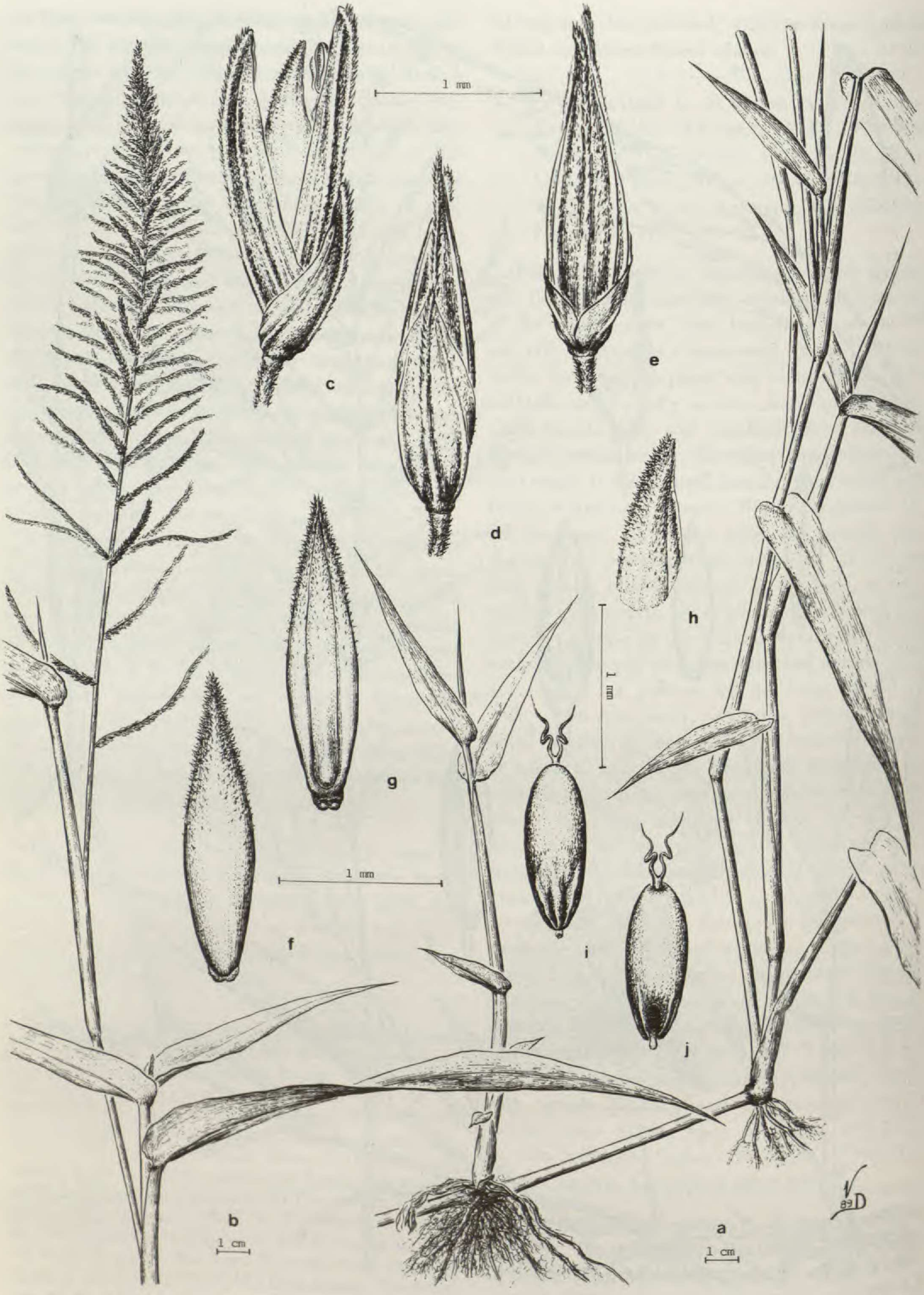


FIGURE 19. *Panicum condensatum* (a, based on *Chase 8101*; b–h, *Chase 12127*; i–j, *Davidse 11494*).—a. Habit.—b. Upper portion of a culm with panicle.—c. Spikelet, lateral view.—d. Spikelet, lower glume view.—e. Spikelet, upper glume view.—f. Upper anthecium, lemma view.—g. Upper anthecium, palea view.—h. Upper portion of the upper lemma showing prickle hairs.—i. Caryopsis, embryo view.—j. Caryopsis, hilum view.

and by the consistency of the upper anthecium, indurate in the latter species and membranous in *P. bresolinii*.

3. Panicum condensatum Bertol., Opusc. Sci. 3: 408. 1819. *Hymenachne condensata* (Bertol.) Chase, J. Wash. Acad. Sci. 13: 177. 1923. TYPE: Brazil. Rio de Janeiro: without precise locality, *Raddi s.n.* (holotype, PI; isotype, K, fragment, US 80598). Figures 5, 6, 19.

Panicum auriculatum Willd. var. *fasciculosum* Doell, in C. Martius, Fl. Bras. 2(2): 238. 1877. *Panicum januarium* Mez, in Engler, Bot. Jahrb. Syst. 56, Beibl. 125: 4. 1921. TYPE: Brazil. Rio de Janeiro: Rio de Janeiro, *Gaudichaud 288* (isotypes, P, W, fragment US 80476).

Annuals or perennials?, the *culms* decumbent, rooting and branching at the lower nodes, then erect, up to 100 cm tall, branching at the middle and upper nodes, internodes compressed, hollow, glabrous, (5–)10–23 cm long, nodes compressed, dark, glabrous. Leaves with *sheaths* shorter than the internodes, 4–10 cm long, with tessellate nerves, glabrous, the margins membranous. *Ligules* membranous at the base and shortly ciliate at the apex, 0.9–1.3 mm long; collar brownish, glabrous to shortly ciliate. *Blades* lanceolate, 7–17 cm long, 1–2 cm wide, flat, acuminate, cordate at the base and amplexicaulous, shortly pseudopetiolate, pseudopetiole brownish, short-pilose and sparingly papillose-pilose, blades glabrous, the margins scabrous, ciliate at the lower margins. *Inflorescence* 13–24 cm long, 1.5–6 cm wide, with approximately 50 unilateral, racemose branches, the branches verticillate, subopposite to alternate; *main axis* wavy, scabrous, lower branches 3–4 cm long, branches and pedicels scabrous, the branches triquetrous, flattened on one side, axils of the branches long-pilose, branchlets absent, the spikelets secund and paired, one subsessile, the other short-pedicellate on the branches, alternating in 2 rows. *Spikelets* lanceolate, brownish, somewhat laterally compressed, 1.9–2.4 mm long, 0.4–0.5 mm wide, scaberulous, acuminate, upper glume and lower lemma subequal, exceeding in length the upper anthecium. *Lower glume* ½ to ¾ the length of the spikelet, 1–1.6 mm long, ovate, acuminate, 3(–5)-nerved, the keel scabrous. *Upper glume* 1.8–2.1 mm long, 5-nerved, the keel scabrous. *Lower lemma* 1.7–2.1 mm long, 5-nerved, keel scabrous. *Lower palea* absent; lower flower absent. *Upper anthecium* lanceolate, 1.5–1.8 mm long, 0.5 mm wide, membranous at maturity, whitish, scabrous at the apex of lemma and palea and with simple papillae all over its surface, the lemma 5-nerved. *Caryopsis* lanceolate, brownish, hilum elliptic, embryo ⅓ or less the length of the caryopsis.

Distribution and ecology. Brazil, from Bahia to Minas Gerais, Rio de Janeiro, São Paulo, and Santa Catarina, in wet places on margins of streams or in marshy areas, up to 500 m elevation. In flower from November to April.

Additional specimens examined. BRAZIL. BAHIA: Cachoeira, *Chase 8101* (US, W). MINAS GERAIS: ca. 1 km S of São Pedro do Suacui along highway MG-3, *Davidse et al. 11494* (MO, SI, US). RIO DE JANEIRO: Rio de Janeiro, Recreio dos Bandeirantes, *Casari 552* (MO); Furnas de Agassiz, *Chase 12127* (US*); Tijuca, *Schott 4845* (US, W); Jacarepagua, *Chase 8414, 8418* (US*); without locality, *Kuhlmann s.n.* (US). SANTA CATARINA: Pedra de Amolar, *Condim 1* (US); Florianópolis, *Klein & Bresolin 9966* (US). SAO PAULO: Pindorama, *Viegas s.n.* (US); without state and locality, *Riedel s.n.* (W).

Pohl & Lersten (1975) indicated that *Panicum condensatum* (as *Hymenachne condensata*) did not have aerenchyma in culms as is typical in other species of the genus *Hymenachne*. *Panicum condensatum* also has the apex of the palea covered by the lemma, and fusoid cells are present in transverse section of the blades. This species has spikelets disposed in first-order branches, as in *P. pilosum* and related species. Its habit is similar to that of *P. grumosum* and *P. pernambucense*.

4. Panicum grumosum Nees, Agrost. Bras.: 182. 1829. *Panicum rivulare* var. *grumosum* (Nees) Hackel, Repert Spec. Nov. Regni Veg. 6: 343. 1909. SYNTYPES: "Habitat in Monte Video et in confinibus Regni Paraguayani (*Sellow*)" (syntype of "Uruguay, Sellow," B; isosyntypes P, W, fragments BAA, US). Figures 3, 7.

Panicum pycnanthum Steudel, Syn. Pl. Glumac. 1: 70. 1853. TYPE: Uruguay. Montevideo: Montevideo, *Deloche s.n.* (holotype, P, fragments BAA, US 2903523).

Panicum pavonii Mez, Bot. Jahrb. Syst. 56, Beibl. 125: 5. 1921. TYPE: Peru. Without locality, *Pavon s.n.* (holotype, B, fragments, BAA, US; isotype, G).

Panicum knuthii Herter, Revista Sudamer. Bot. 6: 137, fig. 6, 1940. TYPE: Uruguay. Minas: Corrales, Feb. 1924, *Schroeder s.n.* (herb. Osten 16731) (fragment of the type, BAA).

Panicum schroederi Herter, Revista Sudamer. Bot. 6: 137, 138, fig. 7. 1940. TYPE: Uruguay. Barra del Santa Lucía, Jan. 1920, *Schroeder s.n.* (herb. Osten 15402). (fragment of the type, US 2903525).

Strongly rhizomatous perennials, *culms* erect, 1.3–2 m tall, freely branching at the upper nodes, internodes cylindric, hollow, glabrous, 8–30 cm long, nodes glabrous, purplish. *Sheaths* glabrous,

shorter than the internodes, 9–20 cm long, the margins membranous, collar glabrous, brownish. *Ligules* membranous, 1.2–2 mm long. *Blades* lanceolate, 14–44 cm long, 0.6–3 cm wide, subcordate, glabrous, the margins scaberulous, midnerve conspicuous. *Inflorescence* a terminal panicle, 15–45 cm long, 3.5–13 cm wide; *main axis* scabrous, branches ascending, alternate or opposite, axis of the branches and pedicels scabrous, spikelets paired and densely crowded on short secondary branchlets, pedicels short. *Spikelets* long-elliptic, 2.3–3 mm long, 0.5–1 mm wide, glabrous, greenish or tinged with purple. *Lower glume* 1–1.7 mm long, ½ to ¾ the length of the spikelet, 3-nerved, the nerves anastomosed toward the apex, the keel scabrous. *Upper glume* 1.8–2.5 mm long, slightly shorter than the lower lemma, 5-nerved, the keel finely scabrous toward the apex. *Lower lemma* 5-nerved, 2.2–2.7 mm long. *Lower palea* 2.2–2.6 mm long, 0.5–0.6 mm wide, membranous, ciliolate on the margins; lower flower male, anthers 3. *Upper anthecium* long-elliptic, 2–2.6 mm long, 0.5–0.7 mm wide, membranous, scabrous toward the apex and with silica bodies and simple papillae; lemma 5-nerved. *Caryopsis* obovate, brownish, 1.1–1.3 mm long, 0.5–0.6 mm wide, plano-convex; hilum oblong, embryo approximately ½ the length of the caryopsis.

Distribution and ecology. South America, from Brazil and Paraguay to Uruguay and Argentina. It is common at margins of rivers and streams, in inundated areas. In flower between October and January.

Selected specimens examined. ARGENTINA. BUENOS AIRES: Isla Santiago, *Cabrera 3422* (F, NY, SI, SP, US); Punta Lara, *Zuloaga 3357* (SI), *3073* (SI*). DISTRITO FEDERAL: Palermo, *Burkart 238* (BAA). CORRIENTES: Isla Apipé Grande, Puerto Mora, *Krapovickas et al. 24388* (CTES, SI). CHACO: Colonia Benítez, *Schulz 1796* (BAB). ENTRE RIOS: Salto Grande, Casa de Piedra, *Renvoize et al. 2975* (K, MO, NY, SI); Concepción del Uruguay, Arroyo La China, *Zuloaga et al. 3087* (MO, SI*). MISIONES: Posadas, *Ekman 622* (CORD, US). SANTA FE: Villa Guillermina, *Meyer 3322* (BAA). BRAZIL. MINAS GERAIS: Caldas, *Regnell III-1361* (P, US). PARANA: Rio Jordão, Aguas Sta. Clara, *Hatschbach 10549* (US). RIO GRANDE DO SUL: Pelotas, *Sacco 212* (NY, RB, US); 20 km from Porto Alegre, grown at Athens, Georgia, *Brown & Barreto 107* (P). SANTA CATARINA: Mun. Caçador, 52 km west of Caçador near the eastern edge of the campos of Palmas, 1,000–1,200 m, *Smith & Reitz 9132* (NY, US); Lages, wet ground, bank of stream and margin of banhado, Fachinal, *Swallen 8126* (US). PARAGUAY. AMAMBAY: Sierra de Amambay, *Hassler 10155* (G, K, LIL, NY, P, W). CAAZAPA: Tavaí, Castor-Cué, 26°10′S, 55°20′W, *Mereles 2188* (MO). CENTRAL: Capiatá, *Schinini 4960* (G, MO, SI). CORDILLERA: Cordillera de Altos, *Fiebrig 421* (F). GUAIRA: prope Villa Rica, in paludosis, *Hassler 8773a* (G). PARAGUARI: Parque Nacional Ybicuí, gallery forest along Arroyo Minas, on trail to Salto Guaraní, 26°03′S, 56°50′W, *Zardini 7474* (MO). PRESIDENTE HAYES: S de Villa Hayes, *Rosengurtt 5627* (BAA, US); Estancia de la "Copacar," El Milagro, *Ramírez 223* (US). URUGUAY. CANELONES: Río Santa Lucía, Estancia Paso Cuello, *Gallinal et al. PE-5571* (MO, P, US). COLONIA: bank of Arroyo de San Juan, *Bartlett 21266* (NY). RIO NEGRO: San Javier, *Chebataroff s.n.* (LIL 57356). SAN JOSE: Río Santa Lucía, *Rosengurtt B-4956* (P, SI). TACUAREMBO: Arazatí, *Rosengurtt 1676* (US).

This species is related to *P. pernambucense*, from which it differs by being commonly smaller in overall size (2–3 m tall in *P. pernambucense*) and by having bigger spikelets (1.7–2.2(–2.5) mm long in *P. pernambucense*) with a conspicuous lower palea and lower flower. *Panicum grumosum* is common in Uruguay and northeastern Argentina, but becomes less common north of these areas. It ranges as far north as Minas Gerais, Brazil, but becomes quite rare. It is difficult to separate the two species in Paraguay.

There is a gradation in the pilosity of leaves and panicles. Some specimens have densely papillose-pilose sheaths covered with rigid, caducous hairs and inflorescences with papillose-pilose rachis and branches; others are glabrous.

Panicum pavonii was described by Mez on the basis of material presumably collected in Peru. We considered this to be an error on the label of the type specimen since the known geographical range of *P. grumosum* does not come close to Peru.

Three-flowered spikelets were found in *Quarín et al. 2745*, *Hunziker 4614* (also with geminate spikelets), and *Millán 568*.

5. Panicum hylaeicum Mez, Notizbl. Bot. Gart. Berlin-Dahlem 7: 75. 1917. *Panicum laxum* Sw. var. *pubescens* Doell, in C. Martius, Fl. Bras. 2(2): 213. 1877, pro parte. TYPE: Brazil. Pará: in vicinibus Santarem, Aug 1850, *Spruce 1061*[2] (*Panicum 26*) (holotype, M, fragment, US; isotypes, K, P). Figures 3, 8, 20.

Panicum minutiflorum Doell, in C. Martius, Fl. Bras. 2(2): 253. 1877. Not *Panicum minutiflorum* Raspail, 1825. LECTOTYPE: Brazil. Pará: prope Santarem, *Spruce 720* (lectotype, here designated, P; isolectotype, K, fragment, US).

Panicum potamium Trin. var. *pubescens* Doell, in C. Martius, Fl. Bras 2(2): 214. 1877, pro parte. TYPE: Brazil. "Ad Tocantins fluvium inter Porto Imperial et Funil," *Burchell 8795* (holotype, K; isotype, W).

Panicum laxum Sw. var. *amplissimum* Hackel, Repert. Spec. Nov. Regni Veg. 6: 343. 1909. TYPE: Paraguay. "in reg. curs. inf. fl. Pilcomayo," *Rojas 276* (holotype, W; isotypes, G, K, P, US, W; fragment of the type, BAA, US).

Panicum schiedeanum Mez, Bot. Jahrb. Syst. 56, Beibl.

FIGURE 20. *Panicum hylaeicum* (a, based on *Guaglianone et al. 728*; e–g, *Spruce 26*).—a. Habit.—e. Hispid spikelet, lateral view.—f. Hispid spikelet, upper glume view.—g. Hispid spikelet, lower glume view.—*Panicum polygonatum* (based on *Buchtien 2501*).—b. Spikelet, lateral view.—c. Spikelet, lower glume view.—d. Spikelet, upper glume view.—h. Upper anthecium, palea view.—i. Caryopsis, hilum and embryo view.

125: 4. 1921. Not *Panicum schiedeanum* Trin. ex Beal, 1886. LECTOTYPE, here designated: Mexico. Without locality, *Schiede 29* (lectotype, B; isolectotype, P, fragment and photo, US 2830931).

Panicum schaffneri Mez, Bot. Jahrb. Syst. 56, Beibl. 125: 4. 1921. Not *Panicum schaffneri* Kuntze, 1898. TYPE: Mexico. Without locality, *Schaffner 156* (holotype, B, fragment, US 2830930).

Panicum doellii Mez, Bot. Jahrb. Syst. 56, Beibl. 125: 6. 1921. SYNTYPES: Brazil. Pará: Santarem, *Spruce 347* (*Panicum n. 18*). Paraguay. Central: Asunción, Apr. 1874, *Balansa 49*; in regione cursus inferiores fluminis Pilcomayo, *Fiebrig 4689*; without locality, *Rojas 276* (isosyntype of *Spruce 347* (*Panicum n. 18*), P, fragments, BAA, US; isosyntype of *Balansa 49*, G, K, P, US; isosyntype of *Rojas 276*, G, P, US, fragments, BAA, US; fragment of the syntype *Fiebrig 4689*, US).

Panicum guianense A. Hitchc., Contr. U.S. Natl. Herb. 22: 487, f. 83. 1922. TYPE: Guyana. Rockstone, 1 Jan. 1920, *Hitchcock 17313* (holotype, US 1038517; isotypes, BAA, F, G, K, NY, W).

Plants perennial, robust, 1–2(–3) m tall, *culms* cylindric, rooting and branching or not at the lower nodes, then erect, sprawling and clambering, many-noded, internodes 4–20 cm long, rigid, hollow, glabrous, tinged with purple, nodes glabrous, purplish. Leaves with *sheaths* equal to or shorter than the internodes, 3.5–10 cm long, stramineous to purplish, pilose to glabrescent, with papillose-pilose, caducous hairs on the upper margins, collar pilose, glabrous. *Ligules* membranous, laciniate to short pilose on the upper portion, 0.3–0.7 mm long. *Blades* ovate-lanceolate, flat, 7–26 cm long, 1–3 cm wide, cordate, clasping at base, shortly pseudopetiolate, attenuate at the apex, densely pilose to glabrescent on both surfaces, the lower margins long-ciliate, otherwise scabrous, the nerves tessellate. *Inflorescence* a terminal, diffuse to contracted panicle 10–32 cm long, 4.5–17.5 cm wide, included or not at the upper sheaths; *main axis* and branches and pedicels scabrous, pulvini short-pilose, first-order branches alternate to opposite, spreading, spikelets unilateral on short, second- or third-order appressed branches, paired on short pedicels 0.5–1.3 mm long. *Spikelets* narrowly elliptic, 1.4–1.7 mm long, 0.4–0.6 mm wide, greenish to purplish, hispid with caducous hairs, to glabrous. *Lower glume* 0.7–1 mm long, less than ½ the length of the spikelet, ovate, acute, amplexicaulous, 3-nerved, the keel scabrous on the upper portion. *Upper glume* 1–1.7 mm long, covering or not the upper anthecium, 5-nerved, blunt. *Lower lemma* 5-nerved, acute. *Lower palea* elliptic, 0.9–1.3 mm long, 0.3–0.5 mm wide, membranous, small in some specimens; lower flower male or absent. *Upper anthecium* elliptic, 1–1.4 mm long, 0.4–0.6 mm wide, scabrous at the apex, otherwise smooth, glabrous, indurate. *Caryopsis* elliptic, 0.9 mm long, 0.5 mm wide, hilum punctiform, embryo less than half the length of the caryopsis.

Distribution and ecology. Mexico, Mesoamerica, Cuba, Dominica, and South America, from Colombia to Argentina. It is common at margins of rivers and swamps or at edge of forest in humid soils, usually scandent over the vegetation, from sea level to 1,500 m.

Selected specimens examined. ARGENTINA. CHACO: Puerto Vilelas, *Schulz 3379* (BAA, CTES, SI). CORRIENTES: Ituzaingó, Puesto de Prefectura, 42 km al E de Ituzaingó, *Zuloaga et al. 624, 2293** (MO, SI). FORMOSA: Estancia Bouvier, *Guaglianone et al. 728* (SI). MISIONES: Santa Ana, camino al balneario Municipal, *Zuloaga et al. 2218* (MO, SI*). BELIZE. Temash River, *Schipp 1372* (G, US). BOLIVIA. BENI: Río Yata, 30 km W de Guayamerím, camino a Riberalta, *Krapovickas & Schinini 35086* (CTES, K). BRAZIL. ALAGOAS: without locality, *Gardner 1435* (K). AMAPA: Igarapé do Lago, *Black & Froes 51-12342* (IAN). AMAZONAS: Rio Solimoes, *Froes 20549* (IAN, US). BAHIA: Rio Itapicuru, *Pinto 687* (US). GOIAS: Santa Rita do Paranahyba, *Chase 11622* (US). MARANHAO: Caxias to Barra do Corda, *Swallen 3595* (IAN, US). MATO GROSSO: bank of Rio S. Lourenço, Barça S. Lourenço, *Chase 11966* (US). MATO GROSSO DO SUL: Porto Esperança, *Chase 11073, 11099* (US). MINAS GERAIS: Capinópolis, Cachoeira Dourada, *Macedo 4545* (US). PARA: Santarem, *Swallen 3311* (US), *Spruce 347* (P, US), *436* (US). PARANA: mouth of Rio Ivaí, *Lindeman & Haas 4322* (K, NY, US). RONDONIA: Forte da Principe da Beira, *Rodriguez 3490* (US). RORAIMA: Rio Mucajaí, Colonia Fernando Costa, *Black & Magalhaes 51-12877* (IAN, US). SAO PAULO: Porto Pulador on the Rio Moji-Guaçu, 8.9 km NNE of RR Station at Santa Eudóxia, *Eiten & Campos 3487* (MO, US). COLOMBIA. CASANARE: Río Casanare, barranco de Atahuarpa, *Cuatrecasas & García Barriga 4238* (COL), *4284* (COL, US). META: Río Meta, Orocué, *Cuatrecasas & García-Barriga 4432* (COL, US). COSTA RICA. ALAJUELA: Cariblanco, *Pohl & Davidse 11024* (US). CUBA. ORIENTE: Sierra de Nipe, Río Pilabo, *Ekman 15105* (G). PINAR DEL RIO: Baños de San Vicente, *Britton et al. 7452* (US). SANTA CLARA: banks of Banao River, *León 5460* (US). DOMINICAN REPUBLIC. Santo Domingo, Cuenca, *Ekman 13305* (G). FRENCH GUIANA. Haut Itany, *Hoock s.n.* (NY). GUATEMALA. ALTA VERAPAZ: Cobán, *von Tuerckheim 1254* (US). ESCUINTLA: South of Río Burrión, northeast of Escuintla, 700 m, *Standley 89612* (US). HUEHUETENANGO: entre Ixcán y Río Ixcán, Sierra de los Cuchumatanes, *Steyermark 49333* (F). IZABAL: Chickasaw Farm of the United Fruit Company, about 15 km north of Quirguá, *Standley 24623* (US). SANTA ROSA: plains north of Los Cerritos, on road between Chiquimulilla and El Ahumado, *Standley 79566* (US). SOLOLA: around lake at Finca Mocá, slopes of Volcán Atitlán, 1,000 m, *Steyermark 47887* (US). GUYANA. Crab Fall, Cuyuni River, *Tutin G-69* (K, US). HONDURAS. COMAYAGUA: below Barranco Trincheras, *Williams & Williams 18435* (US). COPAN: entre Acrópolis y Jaguarteple, *Molina 26236* (F, US). MEXICO. CHIAPAS: 13 km south of Ocozocoautla, *Breedlove & Davidse 54040* (US). SAN LUIS POTOSI: in a tropical forest along Mexico Highway

55 to Xilitla, *Sohns 1449* (US). VERACRUZ: Córdoba, *Hitchcock 6435* (BAA, LIL, P, US). PARAGUAY. AMAMBAY: Pedro Juan Caballero, *Fiebrig 4760* (M). CONCEPCION: zwischen Río Apa und Río Aquidabán, Villa Sana, *Fiebrig 4689* (G, K, US). NEEMBUCU: Alberdi, *Reales 231* (LIL). PRESIDENTE HAYES: Colonia Inglesa, frente a Trinidad, *Sparre & Vervoorst 898a* (LIL). PERU. LORETO: Río Mamón near Río Nanay, *Croat 19893* (MO). VENEZUELA. AMAZONAS: Dpto. Atures, terraplén y área de rebalse del Río Orinoco, en el muelle de Puerto Ayacucho, *Guánchez 2357* (MO, VEN). APURE: Hato San Juan del Río Claro, a orillas del Río Claro, al S de Cunaviche, 1 Feb. 1956, *Borsotti s.n.* (VEN). BARINAS: en cercanías de Ciudad Nutrias, *Zuloaga et al. 4315* (MO, SI*, VEN). GUARICO: at intersection of Río Orituco and road from Calabozo to Cazorla, along river bank, wet soil, semi-erect in shrubs, up to 2 m tall, *Davidse 3716* (K, MO, VEN). ZULIA: Distrito Perijá, 14 airline km NE of the intersection of the Río Aricuaisa and the Maracaibo–La Fría Hwy, 9°26′N, 72°29′W, *Davidse et al. 18411* (MO, NY, VEN).

Panicum hylaeicum is distinguished from *P. laxum* mainly by its cordate and amplexicaulous leaves, and the culms usually rigid. It differs from *P. polygonatum* also by its amplexicaulous leaves, and by having spikelets not pointed, with the lower palea well developed and a lower flower staminate.

Zuloaga (1981) considered this species to be a synonym of *P. boliviense* Hackel. A detailed study revealed that *P. boliviense* is a synonym of *P. polygonatum*, representing only a robust form of the latter species. There is in *P. hylaeicum* a gradation in the pilosity of the spikelet, from some specimens with spikelets densely pilose to others with spikelets completely glabrous.

6. **Panicum laxum** Sw., Prodr.: 23. 1788. TYPE: Jamaica. Without locality, *Swartz s.n.* (holotype, S, photo of the type, K; isotype, M). Figures 4, 9–11.

Panicum agrostidiforme Lam., Tabl. Encycl. 1: 172. 1791. TYPE: "Ex Amer. merid. Communic. A. D. Richard" (holotype, P, fragments, BAA, US 80537).

Panicum tenuiculmum G. Meyer, Prim. Fl. Esseq.: 58. 1818. TYPE: Guyana (holotype, LE, fragment, US).

Panicum leptomerum J. S. Presl, Reliq. Haenk. 1: 311. 1830. TYPE: Without locality, *Haenke s.n.* (holotype, PR, fragment, US 2903500).

Panicum diandrum Kunth, Revis. Gramin. 2: 393, pl. 110, 1831. TYPE: "Crescit in insula Guadelupae inque Brasilia" (type, B not seen, photo and fragment, US 80660).

Panicum ramuliflorum Hochst. ex Steudel, Syn. Pl. Glumac. 1: 65. 1853. TYPE: Surinam. Without locality, *Kappler 1523* (holotype, P, fragment of the type, US 2830942; isotypes, G, M, W).

Panicum psilanthum Steudel, Syn. Pl. Glumac. 1: 66. 1853. TYPE: Uruguay. Without locality, *Deloche s.n.* (not seen).

Panicum laxum Sw. var. *pubescens* Doell, in C. Martius, Fl. Bras. 2(2): 213. 1877, pro parte. SYNTYPES: Brazil. Goiás: Porto Real, *Burchell 8705*. Pernambuco: Without locality, *Gardner 1182*. Without state and locality, *Riedel 943*, *Burchell 3456* (syntype of *Burchell 8705*, W, fragment, US; of *Gardner 1182*, G, K, P, W; of *Riedel 943*, G, K, W; of *Burchell 3456*, W).

Panicum pilosum Sw. var. *epilosum* Fourn., Mexic. Pl. 2: 24. 1886.

Panicum luticola A. Hitchc., Contr. U.S. Natl. Herb. 22: 485, fig. 82, 1922. TYPE: Guyana. Mazaruni River, Penal Settlement, 5 Dec. 1920, *Hitchcock 17313* (holotype, US; isotypes, F, G, K, NY, P, US, W).

Panicum hondurensis Swallen, Contr. U.S. Natl. Herb. 29: 270. 1949. TYPE: Honduras. Valle: San Lorenzo, 10 Sep. 1945, *Rodríguez 3323* (holotype, US 1869140; isotypes, MO, US 1869141).

Panicum caroniense Luces, Bol. Soc. Venez. Ci. Nat. 15: 26, f. 12. 1953. TYPE: Venezuela. Bolívar: cercanías de Santa Elena, 28 Mar. 1946, *Tamayo 3209* (holotype, VEN; isotype, US 80558).

Panicum laxum Sw. var. *vestitum* L. B. Smith & Wasshausen, Bradea 2(35): 245. 1978. TYPE: Brazil. Santa Catarina: Joinville, Palacio Episcopal, 8 Nov. 1957, *Reitz & Klein 5665* (holotype, US 2240919).

Plants perennial, *culms* decumbent and rooting at the lower nodes to stoloniferous, then ascending to erect, 0.15–0.80 m tall, simple or branching at the upper nodes, internodes 2–15 cm long, glabrous, nodes dark, pilose to glabrous. Leaves with *sheaths* 2–11 cm long, pilose with papillose-pilose, caducous hairs to glabrous, the margins ciliate with tuberculate hairs, more so toward the distal portion, collar pilose to glabrous. *Ligules* membranous, shortly laciniate or ciliate at the distal portion, 0.4–0.8 mm long. *Blades* lanceolate, 4–30 cm long, 0.3–1.4 cm wide, flat, rounded to occasionally subcordate at base, sparingly pilose to glabrous, the margins scaberulous. *Inflorescence* terminal, lax to contracted, 6–29 cm long, 2–14 cm wide; *main axis*, branches and pedicels scabrous, axils of the branches short- to long-pilose, first-order branches alternate or occasionally opposite, ascending or spreading, spikelets crowded on short secondary branchlets, pedicels 0.5–1.4 mm long. *Spikelets* narrowly elliptic, 1–1.7 mm long, 0.4–0.6 mm wide, pilose, with caducous hairs, to glabrous, greenish or tinged with purple. *Lower glume* ovate, 0.6–1.1 mm long, ⅖ to ½ the length of the spikelet, 3-nerved, the keel scabrous on the upper portion. *Upper glume* 1–1.6 mm long, covering or not the upper anthecium, 5-nerved, the keel scabrous. *Lower lemma* 0.9–1.6 mm long, 5-nerved. *Lower palea* oblong, 1.1–1.5 mm long, 0.4–0.6 mm wide, membranous, shortly ciliate on the margins, occasionally expanded or not at maturity; lower flower staminate, stamens 3, or occasionally absent. *Upper anthecium* elliptic, 1–1.4 mm long, 0.4–0.5 mm wide, scabrous toward

the apex, papillose, indurate, shining; anthers 2, occasionally 3, 0.3–0.7 mm long. *Caryopsis* elliptic, 0.8–0.9 mm long, 0.4–0.6 mm wide; hilum oblong, embryo ½ the length of the spikelet.

Distribution and ecology. Widely distributed in America, from Mexico to Argentina, and introduced in Africa. It is common in wet and open, disturbed places, in margins of roads, swamps, and rivers, between 0 and 1,500 m.

Selected specimens examined. ARGENTINA. BUENOS AIRES: Isla Martín García, *Parodi 4662b* (BAA). CHACO: Puerto Antequera, *Zuloaga et al. 3319* (SI*). CORRIENTES: 42 km E de Ituzaingó, puesto de Prefectura, *Zuloaga et al. 593, 2298* (SI). ENTRE RIOS: Concepción del Uruguay, borde del Río Uruguay, *Zuloaga et al. 2337* (MO, SI*). FORMOSA: Estancia Monteagudo, *Guaglianone et al. 326* (MO, SI). JUJUY: Calilegua, toma del Río Zora, *Cabrera et al. 30378* (SI). MISIONES: Santa Ana, camino al balneario municipal, *Zuloaga et al. 3170*, 3178* (SI). SALTA: de Río Pescado a Orán, *Cabrera et al. 26510* (SI). SANTA FE: Alto Verde, *Pensiero 116* (SI). TUCUMAN: Acheral, *Venturi 1635* (SI). ANTIGUA. Without locality, *Wullschaegel 623bis* (M). BELIZE. BELIZE: 41 mi. northwest of Belize along Northern Highway, *Croat 23967* (MO). CAYO: 4 km W of Hattieville along the Western Highway to Belmopan, *Davidse & Brant 32998* (MO*). TOLEDO: near border of Stann Creek along Southern Highway, *Croat 24185* (MO). BOLIVIA. BENI: Prov. Ballivián, Estancia El Porvenir, 50 km E of the Río Maniqui (San Borja) on the road to Trinidad, *Solomon 14775* (MO). COCHABAMBA: Campamento Izarzama, *Beck 1587* (LPB). LA PAZ: Zonga valley, below the dam at Lago Zongo, *Solomon 12901* (MO, SI). PANDO: Prov. Manuripi, along Río Madre de Dios, 80 km (by air) downstream from and NE of Chibe, *Nee 31529* (MO). SANTA CRUZ: Montero to Puerto Grether, *Renvoize & Cope 3953* (K, MO, SI). TARIJA: camino a Bermejo, Río Seco, *Coro-Rojas 1434* (LPB). BRAZIL. ACRE: NW of Cruzeiro do Sul, along road from Cruzeiro do Sul to Barao do Rio Branco, *Croat & Rosas 62653* (SI). AMAPA: Campo Experimental do Cerrado, km 45 da rodovia BR-156, *Valls 11644* (CEN). AMAZONAS: Fazenda Santa Terezinha, Costa da Terra Nova, Ilha do Careiro, *Prance & Ramos 23298* (US). BAHIA: by Rio Cumbuca, ca. 3 km S of Mucugé, *Harley et al. 15968* (CEPEC, K, MO). CEARA: Serra do Baturité, S. Inácio do Azevedo, *Eugenio 267* (RB). DISTRITO FEDERAL: Taguatinga Norte, *Silva 257* (IBGE, SP). ESPIRITO SANTO: Mirassol, *Mattos et al. 10849* (SP). GOIAS: ca. 20 km W of Veadeiros, 1,000 m, *Irwin et al. 12931* (MO, NY). MARANHAO: Barra do Corda to Grajaú, *Swallen 3625* (RB). MATO GROSSO: Poconé, Fazenda Ipiranga, *Allem & Vieira 1011* (CEN). MATO GROSSO DO SUL: Fazenda Bodoquena, *Allem et al. 2188* (CEN, MO). MINAS GERAIS: Serra do Espinhaço, 18 km W of Grão Mogol, *Irwin et al. 23558* (MO, P, UB, US). PARA: Santarém, *Spruce Panicum 5* (G, MO, P, M, W). PARANA: Parque Nacional de Sete Quedas, Ilhas dos Saltos, *Sendulsky 1824* (SI, SP). PERNAMBUCO: Beberibe, vicinity of Recife, *Chase 7760* (MO). PIAUI: between Floriano and Oeiras, *Swallen 4166* (US). RIO DE JANEIRO: Leblon, near Lagoa Rodrigo de Freitas, Rio de Janeiro, *Chase 8227* (MO). RIO GRANDE DO SUL: Tenente Portela, Reserva Florestal do Turvo, *Valls et al. 1791* (CEN). RONDONIA: vicinity of Santa Bárbara, 15 km east of km 117, *Prance & Ramos 7168* (MO). RORAIMA: vicinity of Caracaraí, along BR-174 road, between Caracaraí and Rio Branco, *Coradin & Cordeiro 1040* (CEN). SANTA CATARINA: 6 km N of Abelardo Luz, *Smith & Klein 15617* (SI). SAO PAULO: 1 km NE of Juquitiba along Highway 116 to Curitiba, *Davidse et al. 10914* (MO). COLOMBIA. AMAZONAS: Trapecio Amazónico, between Amazon and Putumayo water sheds, *Black & Schultes 46-396* (COL). ANTIOQUIA: Medellín, *Archer 351* (COL). ARAUCA: kilometro 13 al Sur de Arauca, Laguna El Venero, Hato de Tiberio Sosa, *Jorgenson 28* (COL). BOYACA: Villa de Leyva, *Zuloaga et al. 4181, 4183* (COL, MO, SI*). CALDAS: La Dorada, Hacienda "El Palmar," *Restrepo s.n.* (COL). CAQUETA: Florencia, Granja Macagual del I.C.A., *Echeverry 2477* (COL). CASANARE: Río Casanare, Hato "El Mochuelo," *Jaramillo 164* (COL). CAUCA: Guapi, Parque Nacional de Isla Gorgona, camino a Pablo Sexto, *Lozano & Rangel 5218* (COL). CHOCO: Hoya del Río San Juan, Andagoya, *Forero et al. 5120* (COL). GUAINIA: Río Inírida, Caranacoa, *Fernández et al. 7091* (COL); MAGDALENA: Santa Marta, *Smith 202* (COL, SI, W), *204* (COL, G, P). META: Puerto Gaitán, 4 km al W, borde de arroyo, *Zuloaga 3983* (COL, MO, SI*). NARINO: El Pedregal y Pilcuan, *Mora 2491* (COL). NORTE DE SANTANDER: Abrego, *García & Cabrales 6* (COL). SANTANDER: Barrancabermeja, carretera a El Llanito, *Schmidt-Mumm 450* (COL). TOLIMA: Ibagué, Planta Eléctrica de Mirolindo, 1,200 m, *Echeverry 1188* (COL). VALLE: Cartago, Santa Ana de los Caballeros, *Cuatrecasas 23036* (P). VAUPES: raudal de Yuruparí, *Schultes & Cabrera 19735* (US). VICHADA: 20 km NW of San José de Ocuné, *Hermann 10944* (COL). COSTA RICA. ALAJUELA: Carrillos de Poas, *Brenes 20172* (NY). GUANACASTE: Finca La Pacífica, 5 km NW of Cañas, *Pohl 12959* (MO). HEREDIA: roadside in pasture, 10 km SSE of Puerto Viejo, E side of Río Puerto Viejo, *Pohl 12819* (MO). LIMON: north shore or the mouth of the Río Colorado at Barra del Colorado, between the village and the Caribbean sea, *Davidse & Herrera 30979* (SI). PUNTARENAS: along west side of Río Grande de Tarcoles, ca. 0.5 km S of mouth of Río Turrubares, *Grayum et al. 5238* (MO). SAN JOSE: along Río Conejo in the valley of the Río Alumbre, *Pohl & Davidse 11059* (MO). CUBA. CAMAGUEY: vicinity of La Gloria, *Shafer 174* (US). ISLA DE LA JUVENTUD: San Pedro and vicinity, *Britton & Wilson 14803* (US). HABANA: Laguna de Ariguanabo, *Ekman 13092* (G). ORIENTE: Bayate, *Ekman 6065* (G). PINAR DEL RIO: Sierra de los Organos, Grupo del Rosario, *Ekman 12957* (US). SANTA CLARA: Minas de Motembo, *León et al. 8613* (US). DOMINICAN REPUBLIC. LA VEGA: vicinity of Jarabacoa, 500–1,200 m, *Allard 14513* (US). PACIFICADOR: Pimentel, near sea level, *Abbott 687* (US). ECUADOR. GUAYAS: Milagro, *Asplund 5761* (P). IMBABURA: Lita, *Acosta Solís 12150* (F). LOS RIOS: 14 km SE of Quevedo, *MacBryde 1119* (MO). NAPO: Carretera Hollín–Loreto, km 40–50, *Hurtado 688* (MO). PASTAZA: Mera, *Asplund 18340* (P). PICHINCHA: Puente Gloria de María, *Asplund 7271* (G). EL SALVADOR. AHUACHAPAN: vicinity of Ahuachapán, *Standley 19824* (US). LIBERTAD: Hwy. 2, ca. 20 km E of La Libertad, crossing of Río Tihuapa, *Pohl 11856* (MO). FRENCH GUIANA. Passoura, *Black & Klein 54-17230* (IAN, NY). GRENADA. Without locality, *Broadway 1870* (M). GUADELOUPE. Montebello, *Questel 503* (P, US). GUATEMALA. ALTA VERAPAZ: Panzos, along road to Hidrochulac and Cahabon from Tactic–El Estor road, *Stevens et al. 25354* (MO*). IZABAL: between El Estor and plant of abandoned nickel mine, *Stevens & Martínez*

25275 (MO*). PETEN: Sabanas y bosque secundario de Santa Rita, 20 kms al sur de Santa Elena, *Molina 15523* (MO). GUYANA. Rupununi, *Chan Choong 25* (US). HAITI. Massif de la Hotte, western group, Dame-Marie, Etang-Dérémond, *Ekman 10473* (US). HONDURAS. ATLANTIDA: Orillas del Río Piedras Gordas, Tela, *Ordonez 6* (MO). CHOLUTECA: Marcovia, 20 km NE de Choluteca, *Argenal 33* (MO). COMAYAGUA: Vado Alto, orilla del Río Sulaco, *Nelson et al. 7671* (MO). COPAN: Ocoteseco, 20 km NE de Santa Rosa de Copán, 1,300 m, *Portillo 47* (MO). EL PARAISO: near Piedra Herrada, drainage of the Río Yeguare, *Williams 15982* (MO). GRACIAS A DIOS: Alrededores del Río Platano, *Clewell & Cruz 4167* (MO). FRANCISCO MORAZAN: Alrededor de Nueva Tatumbla, 20 km al SE de Tegucigalpa, *Maradiaga 68* (MO). OLANCHO: Montaña de Chifiringo, 20 km del campamento, *Izaguirre 36* (MO). SANTA BARBARA: Trinidad, Finca Las Colmenas, *Salguero 15* (MO). VALLE: 3 km E of San Lorenzo along the road to the new sea harbor, *Davidse & Pilz 31687* (MO*). YORO: Victoria, orilla del Río Sulaco, *Nelson et al. 7055* (MO). JAMAICA. Hope Grounds, *Harris 11800* (P). MARTINIQUE. St. Pierre, *Hahn 757, 1536* (G). MEXICO. CAMPECHE: about 9 miles W of Escarcega in calcareous soil, *Reeder & Reeder 6101* (MO). QUINTANA ROO: 15 km SSW of Puerto Morelos on Hwy. 307 to Felipe Carrillo Puerto, *Davidse et al. 20645* (MO). TABASCO: km 10.2 de Huimanguillo hacia Malpaso en carretera Huimanguillo–Malpaso, *Cowan et al. 2574* (MO). TAMAULIPAS: Hacienda Santa En Gracia, *V. Chase 7592* (MO). VERACRUZ: about 2 miles W of Minatitlán in area of tropical vegetation, *Reeder & Reeder 6027* (MO). NICARAGUA. CHINANDEGA: Los Balcones, a 9 km de Somotillo, carretera a Cinco Pinos, *Moreno 11511* (MO). CHONTALES: Hacienda Veracruz, including Cerro La Batea and Cerro Los Charcos, *Stevens 22372* (MO). ESTELI: 1.5 km al N del valle San José de la Laguna, camino a San Nicolás, *Moreno 11361* (MO). JINOTEGA: along road from Hwy. 3 through La Fundadora, between Las Camelias and La Salvadora, *Stevens & Grijalva 15305* (MO). MATAGALPA: Ranchería, 11 km al NE de Muy muy, *Moreno 24430* (MO). RIO SAN JUAN: meadow along Río San Juan, *Seymour 5295* (MO). ZELAYA: Puerto Cabezas, ca. 14°01′N, 83°23′W, *Stevens 17805* (MO). PANAMA. BOCAS DEL TORO: Alrededores de Quebrada Chica, *Correa et al. 3830* (MO). CANAL ZONE: Cerro Gordo, near Culebra, *Standley 25995* (MO). COLON: vicinity of San Miguel de La Borda, *Croat 9878* (MO). DARIEN: vicinity of Campamento Buena Vista, Río Chucunaque above confluence with Río Tuquesa, *Stern et al. 834* (MO). LOS SANTOS: one mile south of Pedasi, *Correa 70* (F). PANAMA: between Pacora and Chepo, *Woodson et al. 1632* (MO). VERAGUAS: roadside savanna 2–4 miles E of Santiago, *Duke 12346* (MO). PARAGUAY. ALTO PARANA: Puerto Bertoni, *Bertoni 4951, 3673, 3602, 5831, 5846* (W). AMAMBAY: Pedro Juan Caballero, *Fiebrig 4776* (G, W). CAAGUAZU: Caaguazú, *Balansa 56a* (P). CAAZAPA: Tavaí, *Mereles 2297* (MO). CENTRAL: Asunción, *Balansa 57, 58* (G, P). CONCEPCION: Río Apa, *Hassler 8189* (P). CORDILLERA: Cordillera de Altos, Cerro Tobatí, *Schinini 24029* (G, MO). GUAIRA: Azucarera de Tebicuary, Río Tebicuary, *Schinini 5907* (G, SI). MISIONES: Santiago, Estancia La Soledad, *Pedersen 3260* (SI). PARAGUARI: Paraguarí, *Balansa 57c* (G, P). PRESIDENTE HAYES: Pilcomayo River, *Morong 977* (G, MO). PERU. AMAZONAS: ridge above Cikan Ece Creek, *Berlin 1643* (MO). CUZCO: entre Otalaya y Salvación, *Vargas 16277* (US). HUANUCO: Tingo María, *Asplund 13003* (P). JUNIN: Prov. Satipo, km 41 on road to Satipo, 1,000 m, *Smith et al. 1438* (MO). LORETO: Prov. Alto Amazonas, Capahuari Sur (Campamento Petrolero), *Vásquez et al. 3023* (MO). MADRE DE DIOS: Prov. Manú, Parque Nacional del Manú, Cocha Cashu Station, *Foster 9864* (MO). PASCO: Oxapampa, Río Iscozacín, tributary of Río Palcazu, *Knapp et al. 7830* (MO). SAN MARTIN: Quebrada de Canuto, *Schunke Vigo 10661* (K, SI). PUERTO RICO. 8 km SW of Vega Baja, *Mac Kee 10605* (P). SURINAME. Near Kayser Airstrip, *Irwin et al. 57554* (MO, NY, P, US). TRINIDAD & TOBAGO. Piarco Savanna, south of Arouca, *Hitchcock 10343* (US). URUGUAY. San José, Río Santa Lucía, Colonia Etchejare, *Rosengurtt B-4957* (P). VENEZUELA. AMAZONAS: Depto. Atabapo, Salto Yureba, Cerro Yureba, *Liesner 18764* (MO). ANZOATEGUI: Morichal El Pinal, 3 km norte de San Diego de Cabrotica, *Montes 1756* (MO). APURE: N de casa principal de UNELLEZ, en médano grande, *Zuloaga et al. 4330* (MO, SI*, VEN). BARINAS: cercanías de Ciudad Nutrias, 8°5′N, 69°19′W, *Zuloaga et al. 4313* (MO, SI, VEN). BOLIVAR: entre Piedra de la Virgen y la parte alta de la Escalera, carretera a la Gran Sabana, *Zuloaga et al. 4401* (MO, SI, VEN). COJEDES: San Carlos, *Burkart 16161* (SI). FALCON: Carretera Coro–Mirimire, cerca del Río Hueque, *Wingfield 6227* (MO). GUARICO: 21 km SSE of Calabozo along road to Cazorla, 95 m, *Davidse 3752* (MO, PORT). LARA: en potreros irrigados de Sicarigua, *Burkart 16657* (SI). MIRANDA: Cerros del Bachiller, near east end, between Quebradas Corozal and Santa Cruz, south of Santa Cruz, *Steyermark & Davidse 116468* (MO). MONAGAS: Alrededores de Laguna Grande, a unos 15 km, *Aristeguieta 3909* (MO). PORTUGUESA: a 4 km al Oeste de Guanare hacia Ciudad Barinas, *Zuloaga et al. 4302* (MO, SI, VEN). SUCRE: 8 km al N de Santa Fé, entre Barcelona y Cumaná, *Zuloaga et al. 4367* (MO, SI*, VEN). TACHIRA: alluvial flats, at El Vado, along Río Lobatera, in Parcelamiento Guarumito, 5.5 km west of La Fría (by air), *Steyermark et al. 120340* (MO). YARACUY: San Felipe, orilla del Río Yaracuy, *Burkart & Tamayo 16430* (SI). ZULIA: Distrito Perijá, between the Ríos Yasa and Tucuco along the Machiques and Los Angeles de Tucuco road, *Davidse et al. 18393* (MO).

This species has a wide distribution and a great amount of variability. There are small to medium specimens, some with contracted panicles, described as *P. luticola* and *P. caroniense*; others have open panicles, spikelets pilose or glabrous, and flowers with two (unusual in *Panicum*) or three anthers.

Specimens previously included in *Panicum hondurensis*, a species considered here as a synonym of *P. laxum*, are characterized by having the upper anthecium covered by verrucose papillae regularly distributed. This character links the species to subgenus *Steinchisma*. Also, there are other specimens of *P. laxum*, such as *Smith 202*, *Schunke Vigo 10661, 10802*, *Duke 11684 (2)*, *Lewis & Pire 808*, and *Arbo et al. 1348*, that have the upper anthecium with verrucose papillae all over its surface; these specimens are intermediate in this character with species of subgenus *Steinchisma*.

FIGURE 21. *Panicum leptachne* (based on *Chase 8803*).—a. Habit.—b. Detail of ligule, sheath and blade.—c. Racemose unilateral branch.—d. Axis of a branch with hairs and pedicels.—e. Detail of paired, short pedicels on a branch.—f. Spikelet, lateral view.—g. Spikelet, lower glume view.—h. Spikelet, upper glume view.—i. Lower palea with lodicules and filaments of stamens.—j. Upper anthecium, lemma view with prickle hairs at the upper portion.—k. Upper anthecium, palea view.

7. **Panicum leptachne** Doell in C. Martius, Fl. Bras. 2(2): 195. 1877. TYPE: Brazil. Without locality, *Widgren 1157* (holotype, S, fragment US 80737). Figures 4, 21.

Panicum pilosum Sw. var. *polychaetum* Hackel, Ergeb. Bot. Exped. Akad. Wiss. Sudbras.: 9. 1906. TYPE: Brazil. São Paulo: prope Rio Grande inter Santos et Urbem São Paulo, 750–800 m, 1902, *Wacket s.n.* (holotype, W, fragment, US 2907505).

Plants of indefinite duration, probably perennial, the *culms* erect, ca. 100 cm tall, simple, internodes compressed, hollow, glabrous, nodes compressed, dark, densely pilose with appressed, whitish hairs to glabrous. *Sheaths* 11–14 cm long, longer than the internodes, with tessellate nerves, covered by short, appressed papillose-pilose hairs to glabrous, the margins short-ciliate with papillose-pilose hairs. *Ligule* membranous, 0.8–1 mm long, laciniate at apex. *Blades* lanceolate, 13–22 cm long, 1.8–2.5 cm wide, shortly pseudopetiolate, pseudopetiole sparingly pilose, brownish, blades flat, cordate, acuminate, glabrous. Peduncle ca. 10 cm long, glabrous. *Inflorescence* a terminal, ovate panicle 25–40 cm long; *main axis* wavy, scaberulous and sparingly pilose near the axils of branches, first-order branches ascending, numerous, axis triquetrous, with one side flattened, scabrous and covered with conspicuous, long papillose-pilose hairs; second-order branches absent; spikelets paired and secund on short, scabrous pedicels. *Spikelets* narrowly elliptic, 2.1–3.2 mm long, 0.5–0.8 mm wide, greenish or tinged with purple, scabrous on glumes and lower lemma. *Lower glume* 1–2 mm long, ⅖ to ½ or more the length of the spikelet, 3(–5)-nerved, the keel scabrous above, acute. *Upper glume* 5(–7)-nerved, not covering the apex of the upper anthecium, cucculate. *Lower lemma* 3(–5)-nerved, the keel scabrous above. *Lower palea* lanceolate, brownish, 1.7 mm long, 0.4 mm wide, hyaline, glabrous, to absent; lower flower present, with 2 lodicules and 3 anthers, or absent. *Upper anthecium* narrowly elliptic, 1.8–2.5 mm long, 0.6–0.7 mm wide, brownish, membranous, scabrous at the apex of lemma and palea; lemma 5-nerved. *Caryopsis* obovate, 1.2 mm long, 0.6 mm wide, plano-convex, brownish; hilum oblong, embryo ⅓ the length of the caryopsis.

Distribution and ecology. This species grows in Brazil in the states of Minas Gerais, Rio de Janeiro, Paraná, and São Paulo, in wet places up to 650 m elevation.

Additional specimens examined. BRAZIL. MINAS GERAIS: Juiz de Forá, Faz. da Cachoeira, *Roth 1323* (RB, US); Lavras, *Chase 8771* (F, MO, RB, W), *8803* (US*); Viçosa, *Bailey 1177* (US), *Chase 9432* (F, MO, US), *Kuhlmann 1936* (RB), *s.n.* (RB 110562, SI, US); Belo Horizonte, Ressaca, *Mello Barreto 3019* (R, US). PARANA: Serra do Mar, Ypiranga, *Dusén 3664* (R, SI, US, W); Gral. Carneiro, Rio Lajeadao, *Hatschbach 13727* (K). RIO DE JANEIRO: Petrópolis, Caetitú, *Goes & Dionisio 762* (RB). SANTA CATARINA: Canoinhas, campo, 17 km W of Canoinhas on the road to Pôrto Uniao, *Smith et al. 10701* (NY, US). SAO PAULO: Horto Botanico, *Edwall 3859* (SP, US*); Pirajussura, *Gehrt s.n.* (SP 30558); São Paulo, Mogí das Cruzes, *Pickel 5222* (US); without locality, *St. Hilaire 623* (P), *Burchell 4495-2* (K, W), *4355* (K).

Related to *P. pilosum*, *P. leptachne* has bigger spikelets, 2.1–3.2 mm long, and a membranous upper anthecium.

Renvoize (1988) regarded *P. leptachne* as similar to *Hymenachne donacifolia*, differing by having the upper palea enclosed by the lemma at the apex.

8. **Panicum longum** A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 111, fig. 106. 1910. *Panicum pilosum* Sw. var. *macranthum* Scribner, U.S.D.A. Div. Agrost. Circ. 19: 1. 1900. Not *P. macranthum* Trin. 1826. TYPE: Mexico. Veracruz: swamps near Jalapa, *Pringle 8195* (holotype, US* 354552; isotypes, M, NY, P, W). Figure 2.

Plants perennial, ascending or spreading from a ± geniculate base; *culms* 1 to 2 m long, many-noded, simple or sparingly branching from the lower nodes, internodes glabrous, compressed, hollow, nodes dark, compressed, glabrous. *Sheaths* shorter or longer than the internodes, papillose-pilose with long caducous hairs, the margins ciliate. *Ligule* 0.6 mm long, a membrane with a fringe of hairs at the upper portion. *Blades* lanceolate, 10–25 cm long, 0.6–1.2 cm wide, shortly pseudopetiolate, pseudopetiole dark, blades flat, narrowed at base, acuminate, sparsely papillose-pilose on the adaxial surface, glabrous beneath, margins scabrous, the midnerve manifest. *Inflorescence* a terminal panicle 18–25 cm long, 2–5 cm wide, short-exserted or included at base; *main axis* wavy, with long, stiff hairs toward the distal portion, first-order branches ascending, the lower alternate, middle and upper opposite or whorled, axis of the branches triquetrous, flattened on one side, densely papillose-pilose with hairs exceeding the length of the spikelets, second-order branches absent; spikelets secund and paired or occasionally singly on short, scabrous pedicels. *Spikelets* narrowly elliptic, 2.3–2.5 mm long, 0.6–0.7 mm wide, acuminate, scabrous, especially over the nerves of glumes and lower lemma. *Lower glume* 1.3–1.5 mm long, ½ or more the length of the spikelet, acuminate, 3-nerved, nerves anastomosed toward the apex.

Upper glume shorter than the lower lemma, 5-nerved. *Lower lemma* exceeding the upper anthecium in length, 3(–5)-nerved. *Lower palea* absent; lower flower absent. *Upper anthecium* narrowly elliptic, 2–2.2 mm long, 0.6–0.7 mm wide, membranous, scabrous toward the apex and covered with silica bodies. *Caryopsis* unknown.

Distribution and ecology. Mexico, known only from the type collection, growing in swamps.

This species is related to *P. leptachne*, from which it differs slightly by having leaves narrow at their bases and spikelets usually smaller; the two species may be conspecific. However, due to the geographic distribution of *P. longum* and *P. leptachne*, both are maintained as separate species in the present treatment.

9. Panicum pernambucense (Sprengel) Mez ex Pilger in Engler, Nat. Pflanzenfam. (ed. 2) 14e: 15. 1940. *Agrostis pernambucensis* Sprengel, Syst. Veg. 1: 258. 1825. TYPE: Brazil. Pernambuco: Without locality and collector. Figures 5, 12, 22.

Panicum rivulare Trin., Gram. Panic.: 213. 1826. TYPE: Brazil. Rio de Janeiro: Serra dos Orgaos, *Langsdorff s.n.* (holotype, LE, fragments, BAA, US 974638, photo of type, K).

Panicum excelsum Nees, Agrost. Bras.: 180. 1829. TYPE: Brazil. "Habitat in Brasilia meridionale (*Sellow*)" (holotype, B; isotypes, K, US 1061585, fragments, BAA, NY, US 974640, 1061585, 2907336).

Panicum urticans L. B. Smith & Wasshausen, Bradea 2(35): 246, fig. 2 E–G, 1978. TYPE: Brazil. Paraná: Porto Vitoria, barranco do Rio Jangada, 7 Dec. 1971, *Smith & Klein 15715* (holotype, US 2849460).

Robust rhizomatous perennial, 2–3 m tall, *culms* erect, branching at the middle and upper nodes; internodes 8–22 cm long, 0.8–1 cm diam., stramineous, hollow, hirsute to glabrous; nodes pilose to glabrous, dark. *Sheaths* 8.7–18 cm long, glabrous or densely papillose-pilose with caducous hairs. *Ligules* 0.5–1.3(1.8) mm long, membranous; collar brownish. *Blades* lanceolate, 17–60 cm long, 0.8–2 cm wide, subcordate, attenuate at the apex, the margins scaberulous, sparsely pilose to glabrescent, the midnerve conspicuous. *Inflorescence* a terminal, lax panicle 27–40 cm long, 8–12 cm wide; *main axis* scabrous, with or without short hairs, axils of the branches short-pilose, spikelets short-pedicelled, crowded on short, second-order branches, first-order branches ascending to spreading, distant, alternate to opposite, occasionally whorled, appressed, the branchlets short, appressed; pedicels scabrous, short, 0.4–2 mm long. *Spikelets* narrowly elliptic, 1.7–2.2(–2.5) mm long, 0.4–0.8 mm wide, glabrous. *Lower glume* ovate, 0.8–1.2 mm long, ½ the length of the spikelet, 3-nerved, the keel scabrous toward the apex. *Upper glume* 1.4–2.1 mm long, shorter than the lower lemma, 3–5-nerved, the keel scaberulous. *Lower lemma* oblong, 1.7–2.2 mm long, 3–5-nerved, the keel scabrous. *Lower palea* usually absent, when present elliptic, hyaline; lower flower absent. *Upper anthecium* narrowly elliptic, 1.7–2.2 mm long, 0.4–0.8 mm wide, membranous, stramineous, scabrous at the apex of lemma and palea, the rest of its surface with simple papillae and silica bodies. *Caryopsis* elliptic, 0.9–1 mm long, 0.5–0.6 mm wide.

Distribution and ecology. South America, from northeastern Brazil, in the state of Paraiba, to Paraguay and Argentina. It is found at margins of streams and rivers, where it forms huge colonies. In flower between October and February.

Selected specimens examined. ARGENTINA. BUENOS AIRES: San Pedro, Isla del Recreo, *Nicora 3610* (SI). CHACO: Puerto Antequera, *Zuloaga et al. 3323* (SI*). CORRIENTES: ruta nacional 12, 5 km antes del Arroyo Itaembé, *Zuloaga et al. 3232* (SI*). ENTRE RIOS: San Carlos, *Meyer 10811* (LIL); ruta entre Concepción del Uruguay y Gualeguaychú, *Zuloaga & Deginani 2494* (SI*). FORMOSA: Formosa, *Jorgensen 2418* (SI, US). MISIONES: de Apóstoles a Concepción de la Sierra, Arroyo Las Tunas, 2 km de Concepción de la Sierra, *Zuloaga et al. 3251* (SI*); Santa Ana, camino al balneario municipal, *Zuloaga et al. 2235* (MO, SI*). SANTA FE: Reconquista, Isla Mascota, *Job 956* (LP, NY). BRAZIL. BAHIA: Serra do Sincorá, on road to Cascavel, 3 km S of Mucugé, *Harley et al. 15961* (CEPEC, K, MO, NY, P, US). ESPIRITO SANTO: Rodovia BR-101, Rio Santa Maria, *Hatschbach 48776* (K). MATO GROSSO: Porto Frangeli, *Hatschbach 40611* (MO, NY). MATO GROSSO DO SUL: vicinity of Dourados, *Chase 10957* (MO, RB, US). MINAS GERAIS: 9 km NE of Camundacaia, *Davidse & D'Arcy 10563* (K, MO, SP). PARAIBA: Soledade, *Glaziou 16632* (F, P, US, W). PARANA: Pitanga, Borboleta, *Hatschbach 46007* (K, NY, US). PERNAMBUCO: near Santa Esmeralda, *Pires Furtado 119* (RB). RIO DE JANEIRO: Monte Serrat, below Serra de Itatiaia, near Campo Bello, *Chase 8365* (MO, NY, RB, US). RIO GRANDE DO SUL: Vacaria, Vale do Rio Ibitiriá, *Valls et al. 1897* (CTES, US). SAO PAULO: city of São Paulo, 6–7 km SW of center of city, along the Rio Pinheiros, *Skvortzov 90* (K, UB, US). PARAGUAY. ALTO PARANA: Puerto Bertoni, *Bertoni 3889, 4177, 5134* (W). CAAGUAZU: Tacurú, *Sparre & Vervoorst 2229* (LIL). CENTRAL: in regione lacus Ypacaraí, *Hassler 11468* (G, NY, US). CORDILLERA: Cordillera de Altos, Cerro Tobati, *Schinini 23974* (G, SI). GUAIRA: Itapé, *Joergensen 4089* (F, MO, NY, SI, US). PARAGUARI: prope Sapucay, *Hassler 12904* (G, US). SAN PEDRO: Puerto Antequera, *Rojas 2326* (SI).

There is variation in the pilosity of culms and sheaths of this species. In *P. pernambucense* there are specimens with culms and sheaths with abun-

FIGURE 22. *Panicum pernambucense* (based on *Joergensen 2418*).—a. Upper portion of a culm with blade and terminal panicle.—b. Detail of membranous ligule and hairs at the lower portion of the blade.—c. Racemose unilateral branch with paired spikelets.—d. Spikelet, lower glume view.—e. Spikelet, upper glume view.—f. Spikelet, lateral view.—g. Upper anthecium, lemma view.—h. Upper anthecium, palea view.—i. Upper palea with lodicules and stigmas.—j. Caryopsis, embryo view.—k. Caryopsis, lateral view.—l. Caryopsis, hilum view.

dant rigid and caducous papillose-pilose hairs, while others are almost glabrous; the presence or absence of hairs is not correlated with any other character. For this reason, *P. urticans*, which is similar in other respects to *P. pernambucense*, has been included in synonymy.

Panicum pernambucense is similar to *P. grumosum*, and in some cases specimens are difficult to assign to one or the other species, as in several collections from Paraguay (e.g., *Hassler 11468*, *Schinini & Bordas 25190*). However, *P. pernambucense* can be distinguished by its usually smaller spikelets, lower palea absent or less commonly present, lower flower absent, and a wider range of distribution.

10. Panicum pilosum Sw., Prodr.: 22. 1788. *Setaria pilosa* (Sw.) Kunth, Revis. Gramin. 1: 47. 1829. *Panicum distichum* Lam. var. *pilosum* (Sw.) Griseb., Fl. Brit. W. Ind.: 548. 1864. TYPE: Jamaica. Without locality, *Swartz s.n.* (holotype, S; isotype, M, fragment, US 80916). Figures 2, 13, 14.

Panicum distichum Lam., Encycl. 4: 731. 1798. *Setaria disticha* (Lam.) HBK, Nov. Gen. & Sp. 1: 112. 1816. TYPE: "Cette plante croit a la Jamaique" (holotype, P, fragment, US 80650).

Panicum pilisparsum G. Meyer, Prim. Fl. Esseq.: 57. 1818. *Setaria meyeri* Kunth, Revis. Gramin. 1: 47. 1829. TYPE: Guyana. Essequibo: "in graminosis humidis plantitionis Hamburg" (holotype, GOET not seen, fragment, US 2907509).

Panicum pennisetum Roth, Nov. Pl. Sp.: 55. 1821. TYPE: Guyana. Essequibo: *Mertens s.n.* (holotype, B not seen, photo of type, K).

Panicum trichophorum Schrad. ex Schultes, Mantissa 2: 247. 1824. *Setaria schraderi* (Schrad. ex Schultes) Kunth, Revis. Gramin. 1: 47. 1829. TYPE: Brazil: "In Brasilia, Princeps Sereniss. Maximil. Neowidens" (type not seen).

Panicum densiflorum Willd. ex Sprengel, Syst. Veg. 1: 320. 1825. TYPE: "*P. densiflorum* Willdenow. America merid. *Humboldt*" (holotype, B not seen, fragment, US 2903513, photo of type, SI).

Panicum distichum Lam. var. *luxurians* G. Meyer, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 12: 768. 1825.

Panicum distichum Lam. *β lancifolium* Griseb., Fl. Brit. W. I.: 548. 1864. *P. distichum* Lam. var. *lancifolium* (Griseb.) A. Hitchc., Man. Grasses W. Ind.: 267. 1936. *Panicum distichum* Lam. *γ lancifolium* Griseb., Fl. Brit. W. I.: 548. 1864. *Panicum pilosum* Sw. var. *lancifolium* (Griseb. ex A. Hitchc.) Pohl, Fieldiana, Bot. 4: 381. 1980. TYPE: Trinidad. Without locality, *Crueger 84* (fragment and photo of the type, US 80649).

Panicum coenosum Doell, in C. Martius, Fl. Bras. 2(2): 191. 1877. TYPE: Brazil. Amazonas: Manaus, *Spruce 1235* (*Panicum 38*) (isotypes, G, K, M, NY, P, US 1445789, W, fragment, US).

Panicum pilosum Sw. var. *latifolium* Doell, in C. Martius, Fl. Bras. 2(2): 212. 1877. SYNTYPES: Brazil. Rio de Janeiro: Tijuca, 27 Feb. 1870, *Glaziou 4300*, *Raben 169* (isosyntype of *Glaziou 4300*, P, fragment of *Raben 169*, US 80918).

Panicum milleflorum A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 17: 494. 1915. TYPE: Panama. Canal Zone: Frijoles, *Hitchcock 8387* (holotype, US 693327; isotypes, G, K, NY, P, US, W).

Plants of indefinite duration, probably perennial, stoloniferous, *culms* decumbent, rooting and branching at the lower nodes, then erect, 10–70 cm tall, internodes 1.5–13 cm long, compressed, glabrous, nodes brownish to purplish, glabrous to densely pilose with long, whitish hairs. *Sheaths* usually shorter than the internodes, 3–9 cm long, densely papillose-pilose to glabrous, the margins pilose, more so toward the distal portion, collar brownish, pilose to glabrous. *Ligules* small, membranous, to commonly absent. *Blades* lanceolate, 6–28 cm long, 0.5–2 cm wide, shortly pseudopetiolate, subcordate and asymmetric at the base, glabrous to sparsely covered with papillose-pilose hairs on both surfaces, the margins scabrous. *Inflorescence* lax, 9–20 cm long, 2–8 cm wide; *main axis* and branches scabrous and with long hairs, axils of the branches pilose, spikelets crowded and paired, unilaterally disposed on first-order branches, second-order branches absent to occasionally present at the base of the inflorescence, the branches divergent to ascending, pedicels scaberulous, short, 0.4–1 mm long. *Spikelets* narrowly elliptic, 1.2–1.5 mm long, 0.5–0.6 mm wide, biconvex, glabrous to sparsely pilose. *Lower glume* 0.7–1 mm long, 3-nerved, the keel scabrous toward the apex. *Upper glume* 1.3–1.5 mm long, 5-nerved, the keel scabrous. *Lower lemma* 1.2–1.4 mm long, 3-nerved. *Lower palea* 0.4–1.1 mm long, 0.2–0.5 mm wide, equaling in length the lower lemma to small, membranous. *Upper anthecium* narrowly elliptic, 1.2–1.4 mm long, 0.4–0.6 mm wide, glabrous, smooth, finely scabrous at the apex and with simple papillae over the lemma and palea. *Caryopsis* broadly elliptic, brownish, 0.8 mm long, 0.5 mm wide; hilum punctiform, embryo ½ the length of the caryopsis.

Distribution and ecology. Widely distributed from Mexico and the West Indies to South America, from Colombia to Argentina. It is usually found at margins of woods or in disturbed places.

Selected specimens examined. ARGENTINA. CORRIENTES: Puesto de Prefectura, 42 km E de Ituzaingó, *Zuloaga et al. 623*, *2303* (SI*). MISIONES: San Ignacio, Peñón del Teyucuaré, *Zuloaga et al. 3194* (SI*). BELIZE. CAYO: Cave Branch Section, Humming Bird Highway, *Gentle 8868*, *8869* (F). TOLEDO: upper reach, Golden Stream, *Gentle 4582* (MO). STANN CREEK: along road and

stream at Dry Creek, *Croat 24516* (MO, SI). BOLIVIA. BENI: Guayamerín, *Krapovickas & Schinini 35017* (SI). COCHABAMBA: San Rafael, *Steinbach 482* (GH, NY). LA PAZ: Mapiri, *Buchtien 78* (BAF, SI, SP). SANTA CRUZ: Ichilo, de Montero a Puerto Grether, *Renvoize & Cope 3956* (K, LPB). BRAZIL. ACRE: Rio Branco, *Calderón & Soderstrom 2308* (US). ALAGOAS: Porto Calvo, Fazenda Macaitá, *Campelo 2181* (CEN). AMAPA: Estrada de Fazendinha, Macapá, *Rabelo et al. 3319* (MO). AMAZONAS: km 65, on road from Manaus to Bôa Vista, *Lasseign P21166* (US). BAHIA: Itacararé, near the mouth of the Rio de Contas, *Harley et al. 17567* (CEPEC, MO). CEARA: Guaramiranga, Serra do Baturité, *Fernández & Matos 9649* (IBGE). DISTRITO FEDERAL: 10 km S of Brasilia, Fazenda Vargem Bonita, *Irwin et al. 12285* (F, NY, US). GOIAS: Serra do Morcego, ca. 35 km NE of Formosa, *Irwin et al. 15255* (MO, SP, US). MARANHAO: Caxias to Barra do Corda, *Swallen 3532* (SP), *3603, 3589* (US). MATO GROSSO: Poconé, Porto Cercado, *Allem & Viera 1608* (CEN, MO). MINAS GERAIS: ca. 15 km N of São João da Chapada, *Irwin et al. 28155, 28158* (MO). PARA: Conceição do Araguaia, range of low hills ca. 20 km West of Redenção, *Plowman et al. 8595* (MO). PARAIBA: Areia, Escola de Agronomia do Nordeste, *Coelho de Moraes 750* (P). PARANA: Porto de Cima, *Dusén 14334* (MO, SI). PERNAMBUCO: vicinity of Recife, *Chase 7668* (MO). PIAUI: Serra de Araripe, *Luetzelburg 26304* (M). RIO DE JANEIRO: Parque Nacional Itatiaia, Picada Macieiras, *Zuloaga et al. 2355* (MO, RB, SI, US). RIO GRANDE DO SUL: São Leopoldo, *Rambo 41663* (LIL). RONDONIA: Forte Príncipe da Beira do Igarapé da Viúva, *Rodríguez & Wilson 4224* (NY). RORAIMA: along Boa Vista-BV 8 road (BR-174), km 197, *Coradin & Cordeiro 895* (CEN, IAN). SANTA CATARINA: Azambuja, *Smith & Reitz 6005* (SI). SAO PAULO: São Paulo, grounds of the Instituto Botânico, 860 m, *Davidse 10440* (MO). COLOMBIA. AMAZONAS: Río Igará–Paraná, Puerto Buenaventura, *Sastre 2423* (COL). ANTIOQUIA: road to Nechi, ca. 14 km from Caucasia–Planeta Rica road, Hacienda Candelaria, *Brant & Escobar 1253* (MO). BOLIVAR: ca. 16 km NW of San Jacinto, Cerro Maco, ca. 200 m SE of radar installation, *Zarucchi & Cuadros 4029* (MO). CALDAS: Santa Cecilia, *von Sneidern 5064* (F, LIL). CAQUETA: 23 km N of Florencia along main road to Garzón, E slope of Eastern Cordillera, 560 m, *Davidse et al. 5760* (COL, MO). CASANARE: Tauramena, *Uribe 4054* (COL). CAUCA: Guapi, Parque Nacional Isla de Gorgona, camino a Playa Blanca, *Lozano & Rangel 5616* (COL). CHOCO: Bahía de Solano, *Gentry & Forero 7177* (COL, MO). GUAINIA: Raudal Pilón, en el Río Guainía, *Pabon et al. 308* (COL). MAGDALENA: Santa Marta, *Smith 203* (COL, G, MO, W). META: de Cumaral a San Nicolás, 10 km del desvío a San Nicolás, 480 m, *Zuloaga 3868, 3882* (COL, MO, SI). NARINO: Mocoa, *Bristol 235* (GH). PUTUMAYO: selva higrófila del Río San Miguel en la quebrada del Sipenae, *Cuatrecasas 10986* (COL). VALLE: Buenaventura, Vereda Puerto Patiño, *Muñoz 14-48* (COL). VAUPES: Alto Vaupés, alrededores de Miraflores, *Gutiérrez & Schultes 725* (COL). VICHADA: 27 km NE de San José de Ocuné, *Hermann 11013* (COL). COSTA RICA. ALAJUELA: 6 km W of Venicia, 450 m, *Pohl & Davidse 11254* (US). GUANACASTE: road to Upala, ca. 24 km NNE of CIA, *Pohl 12635* (MO). HEREDIA: La Selva, 3 km SE de Puerto Viejo, *Opler 551A* (MO, SI). LIMON: hills 2 airline km SSE of Islas Buena Vista in the Río Colorado, *Davidse & Herrera 31121* (MO, SI). PUNTARENAS: Osa Península, Rincón, *Pohl & Davidse 10744* (US). SAN JOSE: Basin of El General, *Skutch & Barrantes 5111* (MO, US). CUBA. HABANA: Herradura, *van Hermann 763* (W). ISLA DE LA JUVENTUD: Sierra Las Casas, *Killip 44160* (US). ORIENTE: Sierra de Nipe, in pinares, *Alain et al. 8797* (US). PINAR DEL RIO: vicinity of Sumidero, limestone hills, *Shafer 13505* (P). SANTA CLARA: banks of Guayabo River, Banao hills, *León 3982* (US). DOMINICA. South Chiltern Estate between Pointe Michel and Soufrière Bay, *Ernst 1318* (US). DOMINICAN REPUBLIC. LA VEGA: vicinity of Piedra Blanca, *Allard 13145* (US). SEIBO: along road between Miches and El Seibo at crest of Cordillera Oriental, 30 km from El Seibo, 600 m, *Gastony et al. 710* (US). ECUADOR. CARCHI: trail from Pailón to Gualpi Chico area of Awa Reservation, 1.5 km past Río Blanco, *Hoover et al. 2388* (MO). ESMERALDAS: Parroquia de Concepción; Playa Rica, *Mexía 8482* (MO). NAPO: Reserva Biológica Jatún Sacha, Río Napo, 8 km al E de Misahualli, *Ceron 1038* (MO). PASTAZA: Curaray, *Neill & Palacios 6569* (MO, SI). PICHINCHA: Carretera Quito–Puerto Quito, km 113, 10 km al norte de la carretera principal, *Balslev & Balseca 4703* (MO). FRENCH GUIANA. Haut Marony, *Sastre & Moretti 3847* (MO, P). GRENADA. St. Georges, *Broadway s.n.* (US). GUATEMALA. ALTA VERAPAZ: Panzós, along road to Hidrochulac and Cahabón from Tactic–El Estor road, *Stevens et al. 25341* (MO*). IZABAL: slopes WNW (above) El Estor, along margin of open pit nickel mine, *Stevens & Martínez 25219* (MO*). SUCHITEPEQUEZ: near Patulul, *Standley 62150* (US). GUYANA. Wismar, *Hitchcock 17447* (F, IAN, NY, P, US). HONDURAS. ATLANTIDA: vicinity of La Ceiba, *Yuncker et al. 8203* (MO). COLON: Trujillo, Río Negro, SE del cerro Copiro, *Clotter 12* (MO). COMAYAGUA: Centro Acuícola El Carao, *Casco 48* (MO). COPAN: San Francisco mountain, between San Isidro and San Cristóbal, about 10 miles south of Copán Ruinas, *Molina 30696* (MO). CORTES: just S of Puerto Cortés, *Pohl & Davidse 12054* (MO). GRACIAS A DIOS: Alrededores de Puerto Lempira, *Gorgun 19* (MO). OLANCHO: montaña Chifiringo, 20 km de Campamento, *Izaguirre 113* (MO, SI). SANTA BARBARA: above El Mochito, *Pohl & Davidse 12094* (MO). YORO: Cerro between Río Guan Guan and Río Texiguat, E of Cerro Guan Guan, *MacDougal et al. 3258* (MO). JAMAICA. Near Claverty Cottage, Portland, *Harris 11524* (P). MARTINIQUE. Près St. Pierie, *Hahn 787* (G, P). MEXICO. GUERRERO: 8 km al NE de Paraíso, carretera a Puerto del Gallo, *Tenorio et al. 1401* (MO). NAYARIT: steep hillsides 2 miles west of Mazatán, *McVaugh 19104* (US). OAXACA: 8 km del Río Lana rumbo a Palomares, *Beetle M-5063* (MO). QUINTANA ROO: a 25 km al Sur de F. Carrillo Puerto, *Tellez 3025* (MO). SAN LUIS POTOSI: 2 miles east of Tamzunchale, on north side of river, *Hitchcock & Stanford 7304* (US). TABASCO: near the 21 km post W of Huimanguillo on the Huimanguillo–Francisco Rueda road, *G. & J. Davidse 9383* (MO). VERACRUZ: El Mirador, *Beetle M-2254* (MO). NICARAGUA. MATAGALPA: carretera al Tuma, approx. 28 km NE de la ciudad de Matagalpa, finca El Diamante, en los márgenes del Río Yasica, *Guzmán et al. 914* (MO). RIO SAN JUAN: Quebrada Santa Crucita, *Moreno 23441* (MO). ZELAYA: Corn Island, N and W shore, Sand Fly Point to Southwest Bay, *Stevens 19943* (MO). PANAMA. BOCAS DEL TORO: Al NW del campamento Changuinola 1 de Corriente Grande, Cerro Bracha, *Correa et al. 3157A* (MO). CANAL ZONE: between Mindi and Colón, *Hitchcock 7942* (US). COCLE: along road to Coclesito near Saw Mill, *Hammel 4062* (SI). COLON: 5 miles northeast of Sabanita towards Portobello, *Wilbur & Luteyn 11629* (MO). DARIEN: vicinity of Paya,

Río Paya, *Stern et al. 380* (MO). HERRERA: disturbed area surrounding Chepo de las Minas, *Folsom et al. 7026* (MO). PANAMA: Cerro Ancón, *González 12* (MO). SAN BLAS: mainland opposite Playón Chico, 0–3 miles from Caribbean, *Gentry 6357* (MO). VERAGUAS: roadside adventives, road at base of Cerro Tuti, Santa Fé, *Folsom 3002* (MO). PARAGUAY. ALTO PARANA: in regione fluminis Alto Paraná, *Fiebrig 6008* (G, K, LIL, SI). AMAMBAY: in altiplanitie Sierra de Amambay, *Hassler 11993* (G). CAAGUAZU: Coronel Oviedo, *Rojas 14402* (BAF). CANINDEYU: ruta 10, 80 km W de Guairá, cruce Ybyrobara, *Carnevali 3763* (SI). CANTERA: Cantera, *Montes 7222* (SI). GUAIRA: Azucarera de Tebicuary, Arroyo Yhacá, *Schinini 5842* (G, SI). PARAGUARI: Mbocaiatí, près de Paraguarí, *Balansa 2944* (BAF, G, K, P). PERU. HUANUCO: Tingo María, *Vera 4080* (LIL). LORETO: Dtto. Iquitos, Río Nanay, de Pampachica al caserío de Santa Rita, *Rimachi 8014* (MO). MADRE DE DIOS: Rio La Torre, Explorer's Inn, near confluence of Río Tambopata & Río La Torre, 39 km SW of Puerto Maldonado, *Smith 359* (NY). SAN MARTIN: Tingo María, 625–1,100 m, *Allard 20431* (US). SURINAME. Lucie Rivier, 2 km below affluence of Oost Rivier, *Irwin et al. 55199* (MO, NY, US). ST. LUCIA. Savanne Edmund district, southeast of Piton Troumassée, *Proctor 17958* (US). ST. VINCENT. Along Chateubelair River, *Morton 5216* (US). TRINIDAD-TOBAGO. Castara, *Broadway 4063* (G, P). VENEZUELA. AMAZONAS: tall rainforest ESE of Puerto Ayacucho, 10–30 km on road to Gavilán, *Steyermark et al. 113908* (MO). APURE: Dtto. Paéz. Selva de Cutufí, between Cutufí on the Río Cutufí and the Río Sanare, *Davidse & González 21866* (MO*). ARAGUA: Parque Nacional Henry Pittier, Estación Rancho Grande, camino a La Toma, *Zuloaga & Ortíz 4513* (MO, SI*, VEN). BARINAS: Boca de Uribante, 19 km más allá del Caño Anaru, *Trujillo et al. 14951* (F). BOLIVAR: 35 km SW of Caicara del Orinoco, *Steyermark et al. 131246* (SI). DELTA AMACURO: without locality, *Tamayo 3635* (SI). LARA: 30 km SW of Barquisimeto, near road to Cerrata, *Meijer et al. 51* (LIL). FALCON: F6, entre Sanare y el Río Tocuyo, *Wingfield 6855* (MO). GUARICO: Dtto. Infante, Parque Nacional Aguaro-Guariquito, Caño Carnestolendo, *Delascio et al. 11482* (MO). MIRANDA: Guatopo, selvas pluviales, *Bernardi s.n.* (NY). PORTUGUESA: Camino hacia "La Estación," Municipio de Ospino, 1,200 m, *Stergios et al. 4616* (MO, PORT). SUCRE: entre Barcelona y Cumaná, carretera secundaria a 8 km al sur de Santa Fé, 300 m, *Zuloaga et al. 4366* (MO, SI, VEN). TACHIRA: Dtto. Córdoba, Cerro La Camiri, just south of the town of Río Negro, *Davidse & González 21545* (MO). ZULIA: Dtto. Colón, forested slopes at the settlement of Río de Oro along the Río de Oro, *Davidse et al. 18667* (MO).

Panicum pilosum is a very variable species, ranging from small specimens with a reduced panicle to others nearly 1 m tall with large inflorescences. For this reason, *P. coenosum* and *P. milleflorum* are synonymized, the first representing the smaller plants and the latter the larger ones.

In *P. pilosum* the spikelets are paired on secondary branches, as is the case in *P. leptachne* and *P. longum*. Occasionally, small branchlets may be present toward the base of the inflorescence on large specimens. Another peculiar feature of *P. pilosum* is the absence of ligules in most specimens.

11. Panicum polygonatum Schrader in Schultes, Mantissa 2: 256. 1824. *Setaria polygonata* (Schrader) Kunth, Rev. Gram. 1: 47. 1829. *Panicum pilosum* Sw. var. *polygonatum* (Schrader) Doell, in C. Martius, Fl. Bras. 2(2): 211. 1877. TYPE: Brazil. Bahia: Ilheus, 1816, *Prince Maximilian s.n.* (holotype, LE, fragment, US 80925). Figures 3, 15, 23.

Panicum potamium Trin., Gram. Panic.: 239. 1826. TYPE: Brazil. Without locality, *Langsdorff s.n.* (holotype, LE, fragment, US 81301).

Panicum bourgaei Fourn., Mexic. Pl. 2: 25. 1886. TYPE: Mexico. Veracruz: "In valle Cordovense, Januario," *Bourgeau 1662*, pro parte (isotype, P).

Panicum boliviense Hackel, Repert Spec. Nov. Regni Veg. 11: 19. 1912. TYPE: Bolivia. La Paz: Antahuacana, Espírito Santo, 1909, *Buchtien 2501* (holotype, W, fragment, US 80488; isotype, US*, photo of type, K).

Panicum ecuadorense Mez, Bot. Jahrb. Syst. 56, Beibl. 125: 3. 1921. TYPE: Ecuador. Without locality, *Eggers 15064* (holotype, B, fragment, US 80635).

Plants perennial, shortly rhizomatous, with *culms* decumbent, rooting and branching at the lower nodes, then becoming erect, 0.15–0.50(–1) m tall, upper nodes branching or not, internodes cylindric, glabrous to sparsely papillose-pilose, 5–12 cm long, nodes dark, compressed, densely pilose with appressed, retrorse hairs, occasionally glabrous. *Sheaths* shorter than the internodes, 2.7–3.5 cm long, glabrous or rarely papillose-pilose toward the distal portion, the margins membranous, with one margin long-ciliate with papillose-pilose hairs toward the distal portion, collar pilose. *Ligules* membranous, laciniate, 0.3–0.5 mm long. *Blades* lanceolate, 4–15(–20) cm long, 0.6–1.5(–2.5) cm wide, shortly pseudopetiolate, pseudopetiole pilose or glabrous, cordate to subcordate, sparsely pilose with appressed hairs on both surfaces or glabrous, the margins scaberulous, the lower ones ciliate with caducous hairs. *Inflorescence* a lax, pyramidal panicle 8–20(–25) cm long, 3–15 cm wide; *main axis* sparingly hirsute to scabrous, first-order branches alternate, ascending, triquetrous and with or without long hairs, with one side flattened, the spikelets paired on short pedicels on short second-order branches. *Spikelets* narrowly elliptic, 1.3–1.6 mm long, 0.5–0.6 mm wide, pointed at the apex, greenish, pubescent or more commonly glabrous. *Lower glume* ovate, 0.7–0.9 mm long, ½ the length of the spikelet, 1–3-nerved, the keel scaberulous toward the apex. *Upper glume* 1.2–1.4 mm long, glabrous, 5-nerved, acute. *Lower lemma* 1.2–1.4 mm long, 3–5-nerved, acute. *Lower palea* 1.1–1.3 mm long, 0.2–0.4 mm wide, hyaline, glabrous to more commonly absent; lower flower absent, occasionally present with 3 stamens. *Upper an-*

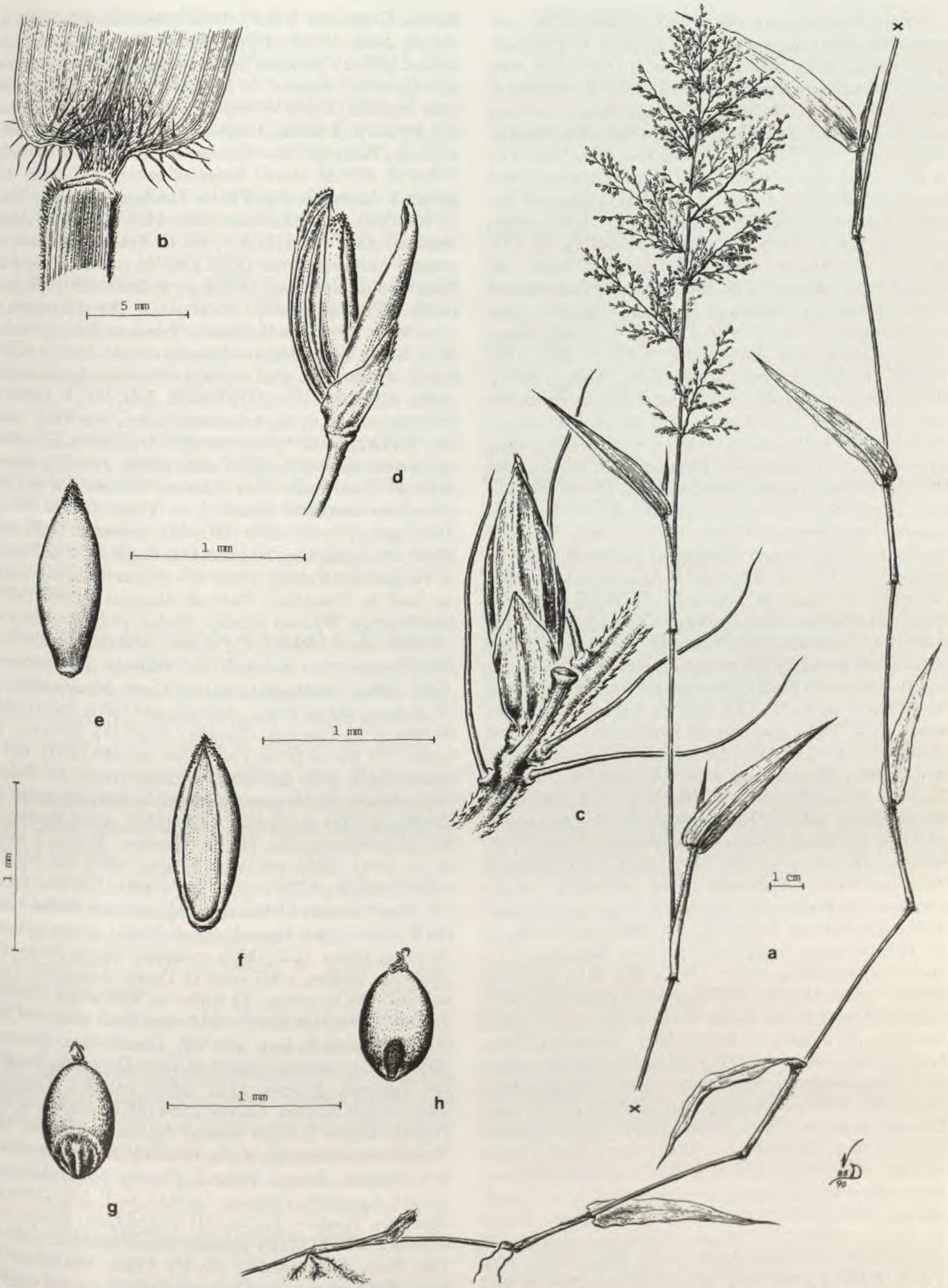


FIGURE 23. *Panicum polygonatum* (a, based on *Chase 8555*; b–h, on type specimen).—a. Habit.—b. Ligule and base of blade.—c. Branch of a panicle with spikelet.—d. Spikelet, lateral view.—e. Upper anthecium, lemma view.—f. Upper anthecium, palea view.—g. Caryopsis, embryo view.—h. Caryopsis, hilum view.

thecium elliptic, 1.1–1.3 mm long, 0.5 mm wide, stramineous, smooth, indurate, scabrous at the apex; anthers 3, 0.3–0.5 mm long. *Caryopsis* elliptic, brownish, 0.8 mm long, 0.5 mm wide; hilum oblong, embryo ⅓ the length of the caryopsis.

Distribution and ecology. Widely distributed from Mexico to Paraguay, Bolivia and Brazil, occasionally present in Northwestern Argentina. It is found at borders of woods, swamps or in wet places, to 1,600 m elevation.

Selected specimens examined. ARGENTINA. MISIONES: Acaragua, *Bertoni 2822* (LIL, MO, US). BELIZE. STANN CREEK: along road and stream at Dry Creek, near District of Cayo border, *Croat 24517* (MO). TOLEDO: in high ridge, at base of hill near Manga Camp, Edwards Road beyond Columbia, *Gentle 6537* (MO, US). BOLIVIA. COCHABAMBA: San Rafael, *R. Steinbach 484* (MO, NY). LA PAZ: along road between Unduavi and Caranavi, 83.5 km beyond Unduavi, *Croat 51586* (MO*); Tipuani, Hacienda Simaco, *Buchtien 5334* (MO, NY, US*). SANTA CRUZ: Río Surutu, bañados, *Steinbach 6840* (G, K, LIL, MO, NY, US). BRAZIL. ACRE: trail to Rio Iaco from 7 km of road Sena Madureira to Rio Branco, *Prance et al. 7703* (M, MO, P). AMAZONAS: Solimoes, Copatana, beira do Rio Jutahy, *Froes 20594* (IAN, US). BAHIA: Ilheus, area do CEPEC, *dos Santos 3397* (CEPEC, RB), *3789* (CEPEC, K, RB). ESPIRITO SANTO: Santa Barbara do Caparaó, *Chase 10073* (US). GOIAS: Santa Rita do Paranahyba, *Chase 11630* (US). MINAS GERAIS: Juiz de Forá, *Chase 8555* (F, NY, US). PARANA: 9 km E of Guaraniau along highway BR-277 to Curitiba, *Davidse et al. 11283* (MO, UB). RIO GRANDE DO SUL: São Leopoldo, Quinta São Manuel, *Dutra 601* (R). RIO DE JANEIRO: Jardim Botânico, caminho dos Macacos, *Chase 8434* (F, MO, RB, US). RONDONIA: Island in Rio Madeira at mouth of Rio Jaciparana, *Prance et al. 5343* (MO). SANTA CATARINA: Florianópolis, *Zuloaga & Deginani 1878* (SI, US). SAO PAULO: Morro das Pedras, *Brade 7815* (R, SP), *9162* (IAN, R). COLOMBIA. AMAZONAS: Río Loretoyacu, *Black & Schultes 46-122* (US). ANTIOQUIA: carretera al mar en los alrededores del Río Ampurrumiado, *Gutiérrez & Barkley 17C172* (LIL, SI, US). CALDAS: Chinchina, *Cuatrecasas 23387* (US). CAQUETA: Miramar, Río Caquetá, *Soderstrom 1401* (K, MO). CASANARE: Tauranema, *Uribe 4268* (COL, NY). CAUCA: entre El Estrecho y Balboa, *Zuloaga & Londoño 4238* (COL, MO, SI*). CHOCO: Río Atrato, bocas del Río Tanando, *Idrobo & Cuatrecasas 2665* (US). CORDOBA: 3 km SW of Popales, Planta Providencia, *Alverson et al. 196* (MO, NY). CUNDINAMARCA: San Francisco-Alto Guarama, *Wood 3642* (COL). HUILA: La Plata, Hacienda La Limona, *Lozano et al. 4826* (COL). MAGDALENA: Santa Marta, *Smith 206* (COL, G, K, MO, P). META: entre Villavicencio y Restrepo, 6 km de Restrepo, *Zuloaga 4087* (COL, MO, SI*); Restrepo, Salinas, subida al cerro, *Zuloaga 3913* (COL, MO, SI*). NARIÑO: Trayecto San Isidro–La Planada, 1,500–1,800 m, *Olga de Benavides 9214* (MO). RISARALDA: Santa Cecilia, *von Sneidern 5192* (F, US). SANTANDER: vicinity of Barrancabermejo, Magdalena valley, *Haught 1923* (COL, NY, US). VALLE DEL CAUCA: Alto del Dinde, entre Cartago y Alcala, *Cuatrecasas 22941* (US). VICHADA: Caño Urimica, *Cabrera 2276* (COL). COSTA RICA. ALAJUELA: edge of cleared fields and wooded area bordering steep slopes above the Río Aguas Zarcas, south of Aguas Zarcas, *Burger & Stolze 5136* (MO). CARTAGO: Turrialba, *Pittier & Tonduz 4092* (M). HEREDIA: roadside in pasture, 10 km SSE of Puerto Viejo, E side of Río Puerto Viejo, *Pohl 12818* (MO). LIMON: 6 km W of Guapiles, *Pohl & Calderón 10017* (MO). PUNTARENAS: forest along trail between Las Alturas and Lotonsito, *Davidse 24387* (MO, SI). SAN JOSE: 10 km by road SW of Santiago de Puriscal, *Pohl & Pinette 13287* (MO). ECUADOR. CHIMBORAZO: entre Bucay y Heda, Rosa Mercedes, *Acosta Solís 5254a* (F). COTOPAXI: Tenefuerte, Río Pilato, *Dodson & Gentry 12248* (MO). EL ORO: Porto Velho, *Hitchcock 21256* (US). ESMERALDAS: Parroquia de Concepción, Playa Rica, *Mexía 8417* (MO, US). GUAYAS: Teresita, 3 km west of Bucay, *Hitchcock 20433* (US). IMBABURA: Lita, 500 m, *Acosta Solís 12239* (US). LOS RIOS: Río Palenque Field Station halfway between Santo Domingo de los Colorados and Quevedo, *Gentry 10191* (MO). MORONA-SANTIAGO: near Mendez, *Camp 865* (NY, US). NAPO: Baeza–Tena rd., 46 km S of Baeza, *Luteyn & Boom 8360* (MO, NY). PASTAZA: Hacienda San Antonio de Baron von Humboldt, 2 km al NE de Mera, *Palacios et al. 137* (MO). PICHINCHA: Nanegalito, al NW de Tandapaya, *Acosta Solís 17166* (US). TUNGURAHUA: valley of Río Pastaza, Machai, *Asplund 8527* (G, LIL, NY, P). EL SALVADOR. Ateos, in swamp, *Calderón 1880* (US). FRENCH GUIANA. Crique la Boue de l'Approuague, *Oldeman B-2225* (MO). GUADALOUPE. Without locality, *Bertero s.n.* (G). GUATEMALA. ALTA VERAPAZ: Finca Mercedes, Teleman, Panzos, faldas de la Sierra de las Minas, *Martínez et al. 22729* (MO). IZABAL: Quebradas, *Pittier 8564* (US). GUYANA: Issorora, Aruka River, *Hitchcock 17589* (K, MO, NY, P, US, W). HONDURAS. ATLANTIDA: Lancetilla Valley, near Tela, *Standley 53181, 53529* (US). CORTES: alrededores del centro ceremonial de Pulapanza, *Torres Flores 176* (SI). SANTA BARBARA: San Pedro Sula, 350 m, *Thieme 5578* (US). FRANCISCO MORAZAN: Montaña La Tigra, 30 km NE de Tegucigalpa, *Soihet 200* (MO, SI). OLANCHO: Orillas del Riachuelo Aguaquire, 30 km NE de Culmi, 700 m, *Nelson & Vargas 2660* (MO). YORO: 17–19 km SE of Río Viejo, on road to Olanchito, *Pohl & Davidse 12089* (MO). MARTINIQUE. Without locality, *Sieber 121* (W). MEXICO. CHIAPAS: Finca Mexiquito, *Purpus 7408* (US). VERACRUZ: Jesús Carranza, 1.5 km N del Poblado 2, *Zambrano 1165* (MO). NICARAGUA. BOACO: Cerro Mombachito, al SE de la ciudad de Boaco, *Moreno 248* (MO). CHONTALES: vicinity of La Libertad, *Standley 8848* (F). JINOTEGA: El Cedro, 19 km al N del Cuá, *Moreno 849* (MO). MATAGALPA: falda NW del Cerro Musún, trocha de Palan, *Araquistain & Moreno 2438* (MO). RIO SAN JUAN: El Castillo, 0–100 m, *Nelson 5190* (MO). RIVAS: Ladera N del volcán Concepción, Isla de Ometepe, *Martínez Salas et al. 1493* (MO). ZELAYA: El Salto, along Río Pis Pis and surrounding hills, *Pipoly 3578* (MO). PANAMA. BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *von Wedel 1121* (MO). CANAL ZONE: Barro Colorado Island, at end of Fuertes Cove, *Croat 5255* (MO). CHIRIQUI: Burica Península, Quebrada Mellize, 6 mi south of Puerto Armuelles, *Liesner 450* (MO). COCLE: El Valle de Antón and vicinity, *Seibert 485* (MO). COLON: trail from head waters of Río Boqueron back to fork with Río Escandaloso, *Hammel 3973* (MO). DARIEN: vicinity of Boca Quebrada Venado, Río Tuqueza, *Bristan 1101* (MO). PANAMA: Tocumen International Airport, *Dwyer 1864* (MO). VERAGUAS: Río Primero Braso, 2.5 km beyond Agriculture School Alto Piedra near Santa Fé, *Croat 25464* (MO). PARAGUAY. ALTO PARANA: Puerto Bertoni, *Bertoni 5356* (US). CAAGUAZU: Caaguazú, *Balansa 55* (BAF, G, P, US). CENTRAL: Asunción, *Jiménez 11190* (SI). CORDILLERA: Valenzuela, *Schwarz 11078* (LIL). GUAIRA: Santa Bárbara, près de Villa Rica, *Balansa 54a* (G, P). PERU. AMAZONAS: La Poza, Río Santiago, strip between Calle Piura and the Río Santiago, *Berlin 3678* (MO). HUANUCO: Prov. Pachitea, Comunidad Nativa Santa Marta, on bank of Sungaruyacu, *Smith 1251* (MO, NY). JUNIN: Colonia Perené, *Hitchcock 22059* (US), *22124* (US). LORETO: lower Río Huallaga, *Williams 4469* (US). MADRE DE DIOS: Tambopata Nature Reserve, *Barbour 5245* (MO, NY). PASCO: Oxapampa, Río Iscozacín, tributary of Río Palcazu, *Knapp et al. 7821* (MO). SAN MARTIN: on trail from Lamas to San Antonio east of Río Chupiseña, *Belshaw 3497* (MO, SI,

US). TRINIDAD-TOBAGO. Mason Hall, *Broadway 4476* (G, P). VENEZUELA. AMAZONAS: Neblina base camp, on the Río Mawarinuma, *Davidse & Miller 26917* (MO*, NY, SI); along Río Mawarinuma, 1 to 3 km west of Cerro de La Neblina Base Camp, *Liesner 15696* (MO). APURE: selva de Cutufí between Cutufí on the Río Cutufí and the Río Sanare, *Davidse & González 21844* (MO*, PORT, SI). ARAGUA: Parque Nacional Henry Pittier, Estación Rancho Grande, camino a La Toma, *Zuloaga & Ortíz 4515* (MO, SI, VEN). BOLIVAR: El Dorado, *Couret 258* (US). DISTRITO FEDERAL: alrededores de la Planta Eléctrica de Mamo, *Pittier 11082* (VEN). FALCON: Cerro Socopo, east side above Socopito, 10°30′N, 70°45′W, riverside in shade, *Liesner et al. 8278* (MO, VEN). LARA: Dtto. Iribarren, Laguna Los Papelones, en la selva nublada en la Fila de las Goteras, *Steyermark et al. 103711* (VEN). MERIDA: La Llorona, on road to Amparo, *van der Werff & Ortíz 5754* (MO, NY, PORT, SI). MIRANDA: Dtto. Páez, Quebrada Chaguaramas, *González & Davidse 946* (MO, NY, PORT, VEN). MONAGAS: 10 km WSW of Jusepín, *Pursell 9094* (US, VEN). PORTUGUESA: 5 km NW de la Concepción, *van der Werff et al. 7521* (MO, PORT, SI). TACHIRA: Dtto. Uribante, Empresa Las Cuevas near La Fundación, 71°47′W, 8°50′N, *van der Werff 4900* (MO, VEN). ZULIA: along Río Cachiri, just north of hacienda Salamanca, *Steyermark et al. 123448* (MO, NY, VEN).

Panicum polygonatum is related to *P. laxum*, from which it differs in having narrow, elliptic spikelets, pointed at the apex, the lower palea commonly absent (or when present usually without a lower flower), and cordate to subcordate blades.

Panicum polygonatum differs from *P. pilosum* by having spikelets on short second-order branches, lower palea usually absent and ligule membranous, always present.

The pilosity of the plants varies, with sheaths and blades usually glabrous and nodes densely pilose; branches of the inflorescences vary also from hirsute, similar to *P. pilosum*, to scabrous and without long hairs.

Panicum boliviense Hackel was considered by Hitchcock & Chase (1910), and Zuloaga (1981) to be the species here considered *P. hylaeicum*, which has cordate and amplexicaulous leaves and rigid culms. *Panicum boliviense* actually represents a robust form of *P. polygonatum* that is approximately 1 m tall with cordate leaves and large panicles; specimens of this latter form range from Central America to Ecuador, Peru, and Bolivia.

The specimen *Idrobo & Cuatrecasas 2665* has the lower lemma indurate, similar to the one on the upper anthecium.

12. Panicum stagnatile A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 17: 528, fig. 141. 1915. TYPE: Panama. Canal Zone: Frijoles, 12 Oct. 1911, *Hitchcock 8388* (holotype, US* 693328; isotypes, F, G, K, MO, NY, P, US, W, fragment of type, BAA). Figure 5.

Panicum bernoullianum Mez, Bot. Jahrb. Syst. 56, Beibl. 125: 3. 1921. TYPE: Guatemala. Mazatenango: *Bernouille 543* (holotype, B; isotypes, G, K, NY, fragment of type, US 80485).

Plants perennial, the *culms* prostrate, decumbent and rooting at the lower nodes, then ascending, 1 to 2 m tall, simple or occasionally with sterile branches, internodes 12–20 cm long, cylindric, hollow, glabrous, compressed, brownish, puberulent; nodes compressed, glabrous. *Sheaths* striate, glabrous, the margins ciliate. *Ligules* membranous, short-ciliate at apex, ca. 0.8 mm long. *Blades* lanceolate, 22–35 cm long, 1.5–3 cm wide, flat, with long hairs at the base of the adaxial surface behind the ligule, short-pilose on the adaxial surface and glabrous on the abaxial surface, subcordate to cordate, acuminate at the apex. *Inflorescence* a terminal, pyramidal panicle, 20–40 cm long; *main axis* wavy, scabrous, pulvini pilose, numerous slender first-order branches ascending or spreading, spikelets unilateral on slender second-order branches, axis of the branches and pedicels triquetrous, scabrous. *Spikelets* loosely clustered, lanceolate, 1.6–1.8 mm long, 0.4–0.5 mm wide, pointed, brownish to purplish, scabrous, especially on the keels of glumes and lower lemma. *Lower glume* 0.6–0.9 mm long, ⅓ to ½ as long as the spikelet, 1–3-nerved, acute. *Upper glume* 3(–5)-nerved, not covering the apex of the upper anthecium, obtuse to acute. *Lower lemma* 3-nerved, acute. *Lower palea* absent; lower flower absent. *Upper anthecium* lanceolate, 1.5 mm long, 0.4 mm wide, membranous, scabrous at the apex, whitish, the margins of the lemma inrolled only at the base; anthers 0.4–0.8 mm long. *Caryopsis* unknown.

Distribution and ecology. Southern Mexico to Panama, growing commonly in swamps or margins of rivers or ponds, from sea level to 100 m.

Additional specimens examined. BELIZE. CAYO: Humming Bird Highway, Pry Creek, *Gentle 8909* (G). STANN CREEK: Humming Bird Highway, *Gentle 8408* (US*); Middlesex, *Gentle 3029* (NY). EL SALVADOR. LA LIBERTAD: Near Ateos, 31 km W of San Salvador, *Fassett 28272* (US). GUATEMALA. IZABAL: Puerto Barrios, *Hitchcock 9153* (US). RETALHULEU: Río Coyote, along road 4 km W of Retalhuleu, 300 m, *Standley 87507* (US). HONDURAS. ATLANTIDA: vicinity of Tela, *Standley 54473* (US). MEXICO. CHIAPAS: Escuintla, *Matuda 1861* (GH, US); Acacoyagua, *Matuda 18416* (US). TABASCO: between San Juan Bautista and San Sebastián, *Rovirosa 625* (K, US). VERACRUZ: Campo Experimental de Hule, El Palmar, Zongolica, *Vera Santos 2655* (US). PANAMA. Without locality, *Hayes 214* (K).

Panicum stagnatile is related to *P. pernambucense*; it differs by its lax panicles, with the spikelets more diffuse on the branchlets, plants smaller with culms decumbent, rooting or not at the lower nodes. Spikelets are similar to those of *P. polygonatum*.

13. Panicum stevensianum A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 17: 498, fig. 77. 1915. TYPE: Puerto Rico. Campo Alegre, near Laguna del Tortuguero, 25 Nov. 1913, *Chase 6616* (holotype, US* 693323; isotypes, NY, US). Figure 5.

Plants of indefinite duration, probably perennials, *culms* prostrate, spreading, decumbent and rooting at the lower nodes, then becoming erect, 20–100 cm tall, internodes glabrous, nodes brownish, glabrous. *Sheaths* striate, glabrous or sparsely papillose-pilose with caducous hairs, one margin ciliate toward the apex, collar brownish, glabrous. *Ligules* membranous, shortly ciliate at the apex, 0.4–1 mm long. *Blades* lanceolate, 10–25 cm long, 0.5–1.7 cm wide, flat, subcordate to cordate at the base, the lower margins ciliate to sparsely pilose on the adaxial surface or completely glabrous. *Inflorescence* a terminal, lax to contracted panicle, 8–28 cm long, 1–6 cm wide; *main axis* wavy, scabrous, first-order branches alternate, axis of the branches and pedicels scabrous, spikelets secund or in short second-order branchlets, paired on short pedicels. *Spikelets* narrowly elliptic, 1.9–2.6 mm long, 0.6–0.7 mm wide, greenish or tinged with purple, glabrous, biconvex, upper glume and lower lemma subequal or the upper glume slightly shorter, pointed. *Lower glume* 0.8–1.1 mm long, nearly ½ the length of the spikelet, acuminate, 3-nerved, the keel scabrous. *Upper glume* 5-nerved, the keel scaberulous. *Lower lemma* 5-nerved. *Lower palea* lanceolate, 2 mm long, 0.6 mm wide, hyaline, the margins scaberulous; lower flower bisexual to male or occasionally absent, lodicules 2, truncate, anthers 3, 1.2 mm long, stigma purple, plumose. *Upper anthecium* narrowly ovate, 1.7–1.9 mm long, 0.5 mm wide, whitish, firmly membranous, scabrous at the apex, the rest of its surface papillose and with silica bodies. *Caryopsis* unknown.

Distribution and ecology. West Indies, in Cuba, Puerto Rico, and Guadaloupe, and South America, collected in Colombia, Venezuela, and occasionally in northeastern Brazil.

Additional specimens examined. BRAZIL. PERNAMBUCO: Dois Irmaos, vicinity of Recife, *Chase 7717* (US*). COLOMBIA. CASANARE: cerca del Hato Gandul, al sur del Río Pauto, *Blydenstein s.n.* (SI, US). CUBA. HABANA: Laguna de Ariguanabo, *Ekman 11516, 13093* (both G, NY, P, R, UB, US*), *16929* (US), *León 9030* (NY, US); Laguna de Castellano, *Ekman 16796* (NY, P, R, UB, US*), *Wilson 9558* (NY, US); Batabanó, *Ekman 12630* (US*); clearing in a swampy wood, W of Batabanó, *León 14200* (US). GUADALOUPE. Without locality, *L'Herminier s.n.* (G, P, US). VENEZUELA. GUARICO: Hato Flores Moradas, carretera Calabozo–Camaguán, *Ramia 1213, 1288* (both VEN).

EXCLUDED SPECIES

Panicum scabridum Doell in Martius, Fl. Bras. 2(2): 201. 1877. TYPE: Brazil. Amazonas: Manaus, Campo de Jauari, *Spruce 1281-3* (holotype, K, fragment, US; isotype, P).

Panicum prieurii Mez, Bot. Jahrb. Syst. 125: 3. 1921. TYPE: French Guiana. Without locality, *Leprieur s.n.* (holotype, B? not seen, fragment, US 2830932).

Panicum manacalensis Swallen, Phytologia 14: 77. 1966. TYPE: Venezuela. Amazonas: Río Atabapo, *Wurdack & Adderley 42986* (holotype US; isotypes, F, GH, K, MO, NY, VEN).

This species was included by Zuloaga (1987) in section *Laxa*. *Panicum scabridum* resembles *P. laxum* in that it has a similar habit, ligule, inflorescence and spikelet type, with the lower glume 3-nerved, ½ the length of the spikelet, and the upper glume and lower lemma subequal, 5-nerved. It differs by having an indurate and smooth upper anthecium, with scattered simple papillae toward the apex, but without prickle hairs or silica bodies; also, the caryopsis is completely black in *P. scabridum*.

The leaf anatomy of *P. scabridum* has shown major differences in relation to species of section *Laxa*. In this species there are no fusoid cells, and there are usually two to four cells between contiguous vascular bundles. Aerenchyma is associated with the keel, and the inner mestome sheath has abundant starch grains.

Vouchers for anatomical study: *Eiten & Eiten 10293, Leprieur 14, 452, Davidse 5444, 14617, Wurdack & Adderley 42986, Zuloaga 3984.*

Panicum grande A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 17: 529, fig. 143. 1915. TYPE: Panama. Gatun Lake, *Hitchcock 9178* (holotype, US 693329; isotypes, G, K, NY, P, US, W).

Panicum myrianthum Mez, Bot. Jahrb. Syst. 56, Beibl. 125: 3. 1921. Not *P. miryanthum* Buse, in Miquel, 1854. SYNTYPES: Suriname. Without locality, *Hostmann 434* (syntypes, K, US 974637), *Hostmann et Kappler 253* (syntype, G).

This species differs from the others placed in section *Laxa* by having the upper anthecium indurate with bicellular microhairs toward the apex, a character not present in the species of this section as here defined. Also, the spikelets are not disposed in unilateral branches as is characteristic of species in *Laxa*. In addition, *P. grande* lacks fusoid cells and has conspicuous lacunae in the mesophyll and superposed bundles.

Vouchers for anatomical study: *Black 15352*, *Pires & Silva 4855*, *Gentry et al. 51575*.

Panicum aristellum Doell, in C. Martius, Fl. Bras. 2(2): 22. 1877. TYPE: Brazil. Minas Gerais: without locality, *Widgren s.n.* (holotype, S not seen; isotype, US, fragment, US).

Related to section *Laxa* by its spikelet and upper anthecium type, it differs mainly by having aristate glumes and by lacking fusoid cells in the leaves.

Literature Cited

Bouton, J. H., R. H. Brown, J. K. Bolton & R. Campagnoli. 1981. Photosynthesis of grass species differing in carbon dioxide fixation pathways. Pl. Physiol. (Lancaster) 67: 433–437.

Brown, R. H. & W. V. Brown. 1975. Photosynthetic characteristics of *Panicum milioides*, a species with reduced photorespiration. Crop Sci. (Madison) 15: 681–685.

———, J. H. Bouton, P. T. Evans, H. E. Malter & L. L. Rigsby. 1985. Photosynthesis, morphology, leaf anatomy, and cytogenetics of hybrids between C_3 and C_3/C_4 *Panicum* species. Pl. Physiol. (Lancaster) 77: 653–658.

Brown, W. V. 1977. The Kranz syndrome and its subtypes in grass systematics. Mem. Torrey Bot. Club 23: 1–97.

Christopher, J. & A. Abraham. 1976. Studies on the cytology and phylogeny of South Indian grasses. III. Subfamily VI: Panicoideae, tribe Paniceae. Cytologia 41: 621–637.

Clayton, W. D. & S. A. Renvoize. 1986. Genera Graminum. Kew Bull. Additional Series XIII. London.

Davidse, G. & R. W. Pohl. 1972a. Chromosome numbers and notes on some Central American grasses. Canad. J. Bot. 50: 273–283.

——— & ———. 1972b. Chromosome number, meiotic behavior, and notes on some grasses from Central America and the West Indies. Canad. J. Bot. 50: 1441–1452.

——— & ———. 1974. Chromosome number, meiotic behavior, and notes on tropical American grasses (Gramineae). Canad. J. Bot. 52: 317–328.

——— & ———. 1978. Chromosome numbers of tropical American grasses (Gramineae): 5. Ann. Missouri Bot. Gard. 65: 637–649.

Ellis, R. P. 1976. A procedure for standardizing comparative leaf blade anatomy in the Poaceae. I. The leaf blade as viewed in transverse section. Bothalia 12: 65–109.

———. 1979. A procedure for standardizing comparative leaf blade anatomy in the Poaceae. II. The epidermis as seen in surface view. Bothalia 12: 641–672.

———. 1987. A review of comparative leaf blade anatomy in the systematics of the Poaceae: the past twenty-five years. Pp. 3–10 *in* T. R. Soderstrom, K. W. Hilu, C. S. Campbell & M. E. Barkworth (editors), Grass Systematics and Evolution. Smithsonian Institution Press, Washington, D.C.

———. 1988. Leaf anatomy and systematics of *Panicum* (Poaceae: Panicoideae) in southern Africa. Monogr. Syst. Bot. Missouri Bot. Gard. 25: 129–156.

Gould, F. W. & T. R. Soderstrom. 1967. Chromosome numbers of tropical American grasses. Amer. J. Bot. 54: 676–683.

Hitchcock, A. S. & A. Chase. 1910. The North American species of *Panicum*. Contr. U.S. Natl. Herb. 15: 1–396.

——— & ———. 1915. Tropical North American species of *Panicum*. Contr. U.S. Natl. Herb. 17: 459–539.

Hsu, C. C. 1965. The classification of *Panicum* (Gramineae) and its allies, with special reference to the characters of lodicule, style-base and lemma. J. Fac. Sci. Univ. Tokyo, Sect. 3 (Bot.) 9: 43–150.

Killeen, T. & L. G. Clark. 1986. Fusoid-like cells in *Panicum* section *Laxa* (Poaceae: Panicoideae). Amer. J. Bot. 73: 771.

Ku, M. S. B. & G. E. Edwards. 1978. Photosynthetic efficiency of *Panicum hians* & *Panicum milioides* in relation to C_3 and C_4 plants. Pl. Cell Physiol. 19: 665–675.

———, ——— & R. Kanai. 1976. Distribution of enzymes related to C_3 and C_4 pathways of photosynthesis between mesophyll and bundle sheath cells of *Panicum hians* and *Panicum milioides*. Pl. Cell Physiol. 64: 257–262.

Lazarides, M. 1980. The tropical grasses of Southeast Asia. Phanerogamum Monographiae Tomus XII. Cramer. Vaduz.

Mehra, P. N. 1982. Cytology of East Indian grasses. P. N. Mehra, Chandigarh.

——— & J. D. Chaudhary. 1976. In IOPB chromosome number reports. LIV. Taxon 25: 631–649.

——— & ———. 1981. Male meiosis in some grasses of the tribe Paniceae. II. Genus *Panicum* from Northeastern India. Cytologia 46: 685–698.

Morgan, J. A. & R. H. Brown. 1979. Photosynthesis in grass species differing in carbon dioxide fixation pathways. Pl. Physiol. (Lancaster) 64: 257–262.

Morgan, J. A., R. H. Brown & B. J. Reger. 1980. Photosynthesis in grass species differing in carbon dioxide fixation pathways. III. Oxygen response and enzyme activities of species in the *Laxa* group of *Panicum*. Pl. Physiol. (Lancaster) 65: 156–159.

Núñez, O. 1952. Investigaciones cariosistemáticas en las Gramíneas argentinas de la tribu Paniceae. Revista Fac. Agron. Univ. Nac. La Plata 28: 229–255.

PALACIOS, R. A. 1968. Variaciones en la estructura de las espiguillas en algunas especies argentinas de *Panicum*. Bol. Soc. Argent. Bot. 12: 38–43.

PILGER, R. 1931. Bemerkungen zu *Panicum* und verwandten gattungen. Notizbl. Bot. Gart. Berlin-Dahlem 104: 237–247.

———. 1940. Gramineae. III: Unterfamilie Panicoideae. Pp. 8–15 *in* A. Engler & K. Prantl (editors), Die Natürlichen Pflanzenfamilien, 2nd edition, 14e. Engelmann, Leipzig.

POHL, R. W. 1980. Gramineae. *In*: W. Burger (editor), Flora Costaricensis. Fieldiana, Botany 4: 350–392.

——— & G. DAVIDSE. 1971. Chromosome numbers of Costa Rican grasses. Brittonia 23: 293–324.

——— & N. R. LERSTEN. 1975. Stem aerenchyma as a character separating *Hymenachne* and *Sacciolepis* (Gramineae: Panicoideae). Brittonia 27: 223–227.

RENVOIZE, S. A. 1988. Hatschbach's Paraná Grasses. Royal Botanic Gardens, Kew.

TATEOKA, T. 1962. A cytological study of some Mexican grasses. Bull. Torrey Bot. Club 89: 77–81.

WATSON, L., H. T. CLIFFORD & M. J. DALLWITZ. 1985. The classification of Poaceae: subfamilies and supertribes. Austral. J. Bot. 33: 433–484.

WILSON, J. R., R. H. BROWN & W. R. WINDHAM. 1983. Influence of leaf anatomy on the dry matter digestibility of C_3, C_4, and C_3/C_4 intermediate types of *Panicum* species. Crop. Sci. (Madison) 23: 141–146.

ZULOAGA, F. O. 1981. Notas sinonímicas en el género *Panicum* (Gramineae). Darwiniana 23: 639–649.

———. 1987. Systematics of New World species of *Panicum* (Poaceae: Paniceae). Pp. 287–306 *in* T. R. Soderstrom, K. W. Hilu, C. S. Campbell & M. E. Barkworth (editors), Grass Systematics and Evolution. Smithsonian Institution Press, Washington, D.C.

——— & T. SENDULSKY. 1988. A revision of *Panicum* subg. *Phanopyrum* sect. *Stolonifera* (Poaceae: Paniceae). Ann. Missouri Bot. Gard. 75: 420–455.

——— & T. R. SODERSTROM. 1985. Classification of the outlying species of New World *Panicum* (Poaceae: Paniceae). Smithsonian Contr. Bot. 59: 1–63.

INDEX TO SPECIES NAMES

Numbers refer to the species number of the treatment. Synonyms in *italics*.

INDEX TO SPECIMENS EXAMINED

Each specimen is listed by the first collector, even when other collectors participated in the collecting. Vouchers utilized for anatomical studies are marked with an asterisk.

Abbott 687 (6). Acosta Solís 5254a (11); 12150 (6); 12239 (11); 13840 (11); 17166 (11). Adams 7911 (10); 14050 (10). Aguilar 8 (10); 595 (6); 632 (9). Ahumada 481 (6); 779 (9); 793 (6); 1579 (6); 1637 (CTES); 2980 (9); 2981 (6); 3974 (4). Alain 8797 (10). Allard 13145 (10); 14513 (6); 20431 (10); 21152 (11). Allem 1011 (6); 1302 (6); 1398 (6); 1601 (5); 1604 (5); 1608 (10); 1679 (5); 1746 (6); 2188 (6); 2218 (5); 2237 (6); 2294 (6); 2347 (6); 2371 (5); 2382 (6); 2493 (5). Almeida 279 (11). Alston 7563 (11). Alvarado 69 (6). Alverson 196 (11). Amer. Gr. Hb. 58 (11). Anderson 988 (11); 7497 (10); 35538 (6). Araquistain 2438 (11). Araujo 1470 (9). Arbo 1348 (6); 1406 (6). Archer 351 (6); 729 (11); 938 (9). Argenal 33 (6). Argent B194 (6). Aristeguieta 3909 (6). Asplund 5761 (6); 7271 (6); 7275 (11); 8527 (11); 8951 (6); 12211 (10); 13003 (6); 18340 (6). Ayala 258 (11); 2384 (11). Aymard 274 (6); 654 (11); 1131 (6); 4260 (11); 4685 (6).

Bacigalupo 557 (4); 959 (6); 966 (4); 980 (4). Bailey 933 (11); 1177 (7). Baker 6492 (11). Balansa 42 (9); 43 (9); 43a (9); 54a (11); 55 (11); 56a (6); 57 (6); 57c (6); 58 (6); 59 (6); 1630 (1); 2944 (10); 4914 (1). Baldwin Jr. 3541 (10); 4535 (6). Balslev 2750 (11); 4703 (10). Bang 266 (6); 308a (6). Barbour 5245 (11). Bartlett 8290 (10); 11489 (6); 21266 (4). Beck 1587 (6); 3228 (6); 3246 (6); 3445 (6); 5098 (6); 5153 (6); 7307 (10). Beetle M-2254 (10); M-5063 (10). Belanger 382 (10). Belem 126 (11); 1339 (10). Belshaw 3497 (11). Benoist 1136 (10). Berlin 1643 (6); 3678 (11). Bernardi s.n. (10). Bernoulli 881 (11). Berro 870 (4). Bertero s.n. (11). Bertoni 1063 (10); 2374 (9); 2822 (11); 3546 (10); 3602 (6); 3667 (10); 3673 (6); 3889 (9); 4177 (9); 4951 (6); 4988 (10); 5134 (9); 5356 (11); 5831 (6); 5846 (6). Betancur 358 (11). Black 104 (10); 46-122 (11); 46-396 (6); 46-396A (10); 47-2044 (10); 47-2048 (10); 49-7943 (6); 49-8015 (5); 50-9301 (5); 51-11660 (9); 51-12342 (5); 51-12877 (5); 51-13077 (5); 51-13426 (10); 54-17139 (6); 54-17230 (6); 54-17386 (10). Blackwell 2736 (10). Blair 808 (11); 826 (6). Blydenstein 744 (5); 789 (6); 1003 (6); s.n. (13). Boeke 1271 (10). Boelcke 5104 (4); 6684 (4). Bommer 5 (6). Borsotti s.n. (5). Box 74 (6). Brade 7809 (9); 7815 (11); 9162 (11). Breedlove 54040 (5). Brenes 20172 (6). Bresolin 1171 (6). Bristan 1101 (11). Bristol 235 (10). Brito 239 (10). Britton 7452 (5); 14803 (6); 15595 (6). Broadway 213 (6); 1870 (6); 4063 (10); 4476 (11); 4985 (6); s.n. (10). Brown 19 (6); 107 (4); 120 (9). Buchtien 34 (10); 35 (10); 49 (6); 74 (11); 78 (10); 82 (11); 1182 (10); 4170 (11); 5315 (6); 5334* (11); 7129 (11). Bunting 9394 (10). Burandt Jr V0852 (11). Burchell 2715bis (9); 4161 (9); 4355 (7); 4495-2 (7); 8874 (5). Burger 5136 (11). Burkart 238 (4); 876 (6); 3792 (9); 4345 (9); 4515 (9); 8331 (9); 14015 (6); 14283 (4); 14472 (6); 14479 (6); 14663 (6); 15461 (9); 15473 (6); 16161 (6); 16430 (6); 16657 (6); 19608 (6); 20974 (4); 21064 (4); 21076 (9); 22873 (4); 23237 (6); 24090 (6); 24091 (6); 26826 (9); 26842 (9); 28252 (10). Busey 558 (11).

Cabrera 345 (10); 2276 (11); 2267 (4); 2439 (4); 3271 (4); 3422 (4); 3947 (4); 5395 (4); 7386 (4); 26510 (6); 28933 (10); 28942 (6); 28967 (5); 29206 (10); 29450 (10); 30378 (6). Calderón 1671 (4); 1880 (11); 2308 (10); 2310 (11). Callejas 3524 (10). Camp 865 (11). Campelo 2181 (10). Cano 2047 (6). Cardona 473 (10); 1351 (10); 1477 (10). Carnevali 1648 (5); 2752 (9); 3462 (6); 3763 (10); 4570 (9). Carrasquilla 2021 (6). Casari 552 (3). Casco 48 (10). Castellanos 17739 (4); 25530 (10); 26447 (10); s.n. (10). Cárdenas 700 (11); 7349 (11). Ceron 1038 (10). Chan Choong 25 (6). Chaparro 15 (10). Chase 6753 (6); 7668 (10); 7717* (13); 7760 (6); 8101 (3); 8109 (9); 8145 (6); 8227 (6); 8365 (9); 8414 (3); 8418 (3); 8434 (11); 8503 (9); 8555 (11); 8621 (11); 8636 (9); 8771 (7); 8803* (7); 8802 (11); 8983 (6); 9432 (7); 9435 (11); 9618 (11); 9774 (10); 10073 (11); 10210 (11); 10472 (10); 10576 (9); 10957 (9); 11073 (5); 11099 (5); 11622 (5); 11630 (11); 11966 (5); 12127 (3). Chase, V. 7592 (6). Chebataroff s.n. (4). Clark 7305 (10). Clayton 4282 (9); 4287 (4); 4556 (11); 4648 (10); 4663 (10); 4680 (10). Clemens 4045 (1). Clewell 4167 (6). Clos 1974 (6). Clotter 12 (10). Coelho de Moraes 750 (10). Coello 199 (10). Comastri Filho 36 (5). Condim 1 (3). Contreras 6320 (10). Coradin 895 (10); 1040 (6); 3089 (10). Cordeiro 347 (10). Coro-Rojas 1434 (6). Correa 70 (6); 3157A (10); 3830 (6). Couret 258 (11). Cowan 1229 (6); 1307 (10); 1386 (10); 1997 (10); 2110 (10); 2574 (6); 38177 (10). Cremers 5207 (6); 7508 (10); 8480 (10); 9565 (6). Croat 5255 (11); 7531A (10); 9611 (11); 9878 (6); 9980 (6); 19893 (5); 19919 (6); 23967 (6); 24185 (6); 24516 (10); 24517 (11); 25302 (11); 25464 (11); 25644 (11); 51586* (11); 59597 (11); 62653 (6). Cuatrecasas 4238 (5); 4284 (5); 4432 (5); 8866 (10); 10986 (10); 16440 (11); 16827 (11); 16956 (11); 17078 (11); 17100 (11); 21035 (11); 21366 (11); 22941 (11); 23036 (6); 23387 (11); 24054 (6). Cuezzo 1464 (11); 10712 (5). Curtiss 305 (10).

da Silva 133 (6); 245 (6). Daciuk 151 (10). Davidse 2877 (6); 3186 (10); 3716 (5); 3752 (6); 4347 (10); 5116 (10); 5428 (6); 5760 (10); 9383 (10); 10440 (10); 10563 (9); 10594 (9); 10914 (6); 10960 (9); 11056 (2); 11275 (9); 11283 (11); 11435 (9); 11460 (6); 11476 (11); 11494 (3); 11554 (6); 11597 (9); 11934 (6); 13896 (10); 14643 (6); 17171 (10); 17281 (6); 17594 (6); 18393 (6); 18411 (5); 18595 (6); 18667 (10); 20645 (6); 21477 (6); 21504 (10); 21545 (10); 21844* (11); 21866* (10); 22010 (6); 22513 (6); 24387 (11); 26670 (10); 26858 (10); 26917 (11); 26927 (10); 30979 (6); 31121 (10); 31122 (11); 31687* (6); 32998* (6). de Granville 438-A (6); 2251 (10); 2935 (6). de la Cruz 1815 (10); 3557 (10); 4080 (11). Deddeca s.n. (11). Delascio 11020 (10); 11319 (5); 11344 (5); 11482 (10). Denslow 2434 (6). Diaz 731 (11); 3962 (10). Díaz Piedrahita 3620 (11). Dodson 7687 (11); 7972 (11); 12248 (11). dos Santos 3397 (11); 3789 (11). Duarte 6864 (11). Dugand 2496 (6); 3890 (11). Duke 5929 (6); 11684 (2) (6); 11944 (11); 12346 (6). Dusén 2976 (9); 3664 (7); 14334 (10); 14407 (6); 16061 (6); 16251 (9); 16287 (9). Duss 535 (6). Dutra 601 (11); 603 (6); 630 (4). Dwyer 1864 (11); 10755 (6).

Ebinger 1111 (11). Echeverry 1188 (6); 1636 (11); 2477 (6). Edwall 3859* (7). Eggers 759 (6); 760 (10); 763

(10); 2120 (6); 5534 (10). Eiten 3487 (5). Ekman 620 (9); 621 (9); 622 (4); 624 (10); 625 (10); 6065 (6); 6204 (6); 10473 (6); 10980 (5); 11183 (10); 11499 (5); 11516* (13); 12390 (6); 12630* (13); 12957 (6); 13092 (6); 13093* (13); 13305 (5); 14790 (5); 15105 (5); 16796* (13); 16929 (13). Elmer 14344 (1); 16398 (1). Equipe IBGE 3086 (10); 4169 (10). Ernst 1318 (10). Essed 20 (6). Eugenio 267 (6).

Fabris 61 (4). Fassett 28272 (12). Fernández 339 (10); 1517 (10); 7091 (6); 9649 (10). Feuillet 1478 (10); 2138 (10). Fiebrig 421 (4); 523 (6); 4260 (5); 4316 (6); 4689 (5); 4760 (5); 4776 (6); 5248 (5); 6008 (10). Filgueiras 366 (6); 1198 (6). Folsom 3002 (10); 7026 (10). Fonnegra 486 (11); 2051 (11); 2159 (10). Forero 622 (10); 1277 (10); 3819 (11); 4514 (10); 5120 (6); 7213 (10). Fosberg 9864 (6); 29042 (11). Franceschi 106 (6). Froes 20549 (5); 20594 (11); 23787 (5); 23928 (5); 24551 (5); 25756 (5); 34114 (5); 34303 (10). Fromm 1436 (10). Funck 432 (11).

Gallinal PE-5571 (4). García 6 (6); 44 (10). García Molinari 271 (6). García-Barriga 5336 (11); 10014 (11); 11411 (6); 13881 (6). Gardner 1435 (5); 2352 (10); 2358 (10); 4305 (10). Garrido 7 (10). Gastony 710 (10). Gaudichaud 126 (9). Gehrt s.n. (7). Gentle 3029 (12); 3731 (6); 4582 (10); 6202 (11); 6537 (11); 6926 (10); 7945 (10); 8408* (12); 8868 (10); 8869 (10); 8909 (12); 10191 (11); 17651 (10). Gentry 6357 (10); 7177 (10); 7956 (11); 63702 (11). Gillett 16478 (6). Gillis 8179 (10). Glaziou 4341 (6); 15641 (9); 16614 (9); 16632 (9). Gleason 930 (10). Goeldi 119 (5); 14767 (10). Goes 762 (7). Gómez 23076A (11). González 12 (10); 946 (11). Goodland 734 (6); 1033 (6). Gorgun 19 (10). Grayum 5238 (6); 8517 (6). Griman 106 (6). Guaglianone 326 (6); 327 (5); 410 (9); 498 (6); 722 (9); 728 (5); 1138 (9). Guánchez 2357 (5). Gutiérrez 725 (10); 17C172 (11); 17C548 (11); 35521 (10). Guzmán 914 (10).

Haase 806 (6); 904 (6). Hahn 757 (6); 787 (10); 1536 (6); 2534 (6). Hamilton 1276 (11). Hammel 3973 (11); 4062 (10); 5250 (6); 13065 (11). Harley 15961 (9); 15968 (6); 16596 (10); 17567 (10). Harmon 1883 (10); 2275 (6); 6161 (10); 6452 (10). Harris 11524 (10); 11800 (6). Hassler 19 (6); 2074 (6); 2915 (5); 3763 (4); 8189 (6); 8192 (10); 8385 (6); 8465 (6); 8773 (9); 8773a (4); 9868 (6); 10155 (4); 11468 (9); 11468a (4); 11914 (4); 11993 (10); 12433 (6); 12904 (9). Hatschbach 2578 (4); 10549 (4); 13727 (7); 15801 (5); 28359 (4); 40611 (9); 46007 (9); 48776 (9); 48858 (8); 49013 (9); 51689 (9). Haught 1829 (11); 1923 (11); 3625 (10). Hauman s.n. (10); s.n. (6). Hayes 214 (12). Heringer 17251 (6). Hermann 10944 (6); 10951 (6); 11013 (10); 11113 (11); 11299 (6). Hertzog 1444 (11). Hicken s.n. (4). Hill 12843 (10); 13001 (10). Hilton 11 (6). Hitchcock 6435 (5); 6457 (5); 6582 (5); 6666 (5); 7304 (10); 7942 (10); 7965 (11); 9153 (12); 9333 (6); 9397 (6); 9407 (10); 9423 (10); 9461 (6); 9539 (6); 9782 (10); 9953 (11); 10147 (10); 10306 (11); 10343 (6); 16615 (6); 16671 (10); 17172 (10); 17322 (10); 17407 (10); 17447 (10); 17585 (10); 17589 (11); 19378 (1); 20433 (11); 21256 (11); 22059 (11); 22124 (11); 22712 (11); s.n. (10); s.n. (11). Hoehne 9795 (11). Holm 4 (11). Holt 423 (10). Hoock 112 (5); 118 (10); 124 (10); 294 (6); 512 (6); s.n. (5); s.n. (6). Hoover 2388 (10). Hoyos 416 (10). Huber 2577 (10). Hudson 861 (10). Huet 48 (6). Hugh-Jones 231 (10). Huniker 847 (6); 4614 (4). Hurtado 688 (6).

Ibarrola 183 (6); 995 (4); 1325 (6); 3081 (6). Idrobo 89 (10); 2144 (11); 2665 (11); 4380 (6); 5268 (11); 5308 (10); 5563 (6); 6804 (10); 8474 (6); 8599 (6); 8846 (10); 8915 (10); 9017 (10); 11551 (6). Insfrán 1319 (5). Irwin 11892 (10); 12271a (6); 12285 (10); 12931 (6); 15255 (10); 19028 (10); 21095 (6); 23558 (6); 23818 (9); 24523 (10); 27542 (10); 27845 (6); 28155 (10); 28158 (10); 31028a (9); 55199 (10); 55984 (10); 57554 (6); 57625 (6); 57632 (10). Izaguirre 113 (10). Izaguirre 36 (6).

Jameson s.n. (11). Jangoux 177 (5); 178 (10). Janssen 15 (6). Jaramillo 164 (6); 316 (10); 1090 (6). Jativa 2022 (10). Jenman 1132 (10); 4024 (10); 5968 (10); 5969 (10); 6008 (6). Jiménez 11190 (11). Job 234 (4); 956 (9); 2314 (4). Joergensen 9 (10); 2418 (9); 2449a (5); 3568 (6); 4089 (9); 4105 (9); 4788 (11). Johnson 116 (11); 425 (11); 457 (10). Jorgenson 28 (6). Juncosa 976 (10). Jurgens G-185 (4); G-331 (4).

Kappel s.n. (9). Kermes 1589 (5). Kerr 6952 (1); 7044 (1). Killeen 609 (6); 727 (6); 792 (10); 1380 (11); 1686 (6); 1961 (10). Killip 38810 (10); 44160 (10). Kirkbride 1632 (11). Kirkbride Jr. 185 (10). Klein 1081 (11); 3691 (4); 3827 (4); 9966 (3). Klink 99 (9). Knapp 7631 (11); 7821 (11); 7830 (6). Krapovickas 6861 (6); 15601 (9); 23338 (10); 23772 (9); 24248 (5); 24307 (10); 24388 (4); 24667 (9); 24965 (4); 25572 (5); 26424 (4); 27177 (10); 29503 (9); 35017 (10); 35086 (5). Krauss 1679 (10). Krieger 1211 (9). Kuhlmann 71 (5); 1702 (5); 1936 (7); 1941 (10); s.n. (7); s.n. (11); s.n. (3).

Lanjouw 1887 (10). Larsen 68 (1). Lasseign P21166 (10). Lehmann 631 (6). Leng 33 (10). Lent 1486 (11). León 3982 (10); 5460 (5); 8613 (6); 9030 (13); 14200 (13). Lewis 690 (6); 808 (6); 934 (6); 1036 (9); 1058 (10). Liebmann 419 (5). Liesner 450 (11); 6322 (6); 7763 (11); 8278 (11); 10428A (11); 15693 (10); 15696 (11); 18764 (6). Lima 214 (6). Lindeman 4322 (5). Lindman A-1969 (5). Llamas 612 (10). Loher 1718 (1); 1719 (1). Londoño 254 (11). Lorentz 467 (4). Lozano 349 (10); 1050 (11); 4826 (11); 5218 (6); 5616 (10). Luederwaldt s.n. (9). Luetzelburg 26304 (10). Luna 207 (5). Lundell 6668 (10). Luteyn 8360 (11). L'Herminier s.n. (13); s.n. (6).

MacDougal 3258 (10). MacKee 10605 (6). Macbryde 1119 (6). Macedo 4545 (5); 4554 (10). Maggs 191 (6). Maguire 23242 (10); 23457 (6); 24735a (6); 53694 (6); 54138 (6). Maradiaga 68 (6). Marinho 166 (11). Martínez 22729 (11). Martins 7706 (10). Martius s.n. (10); s.n. (10); s.n. (6). Martínez Crovetto 2687 (4); 4437 (6). Martínez Salas 1493 (11). Mattos 9911 (6); 10849 (6). Mattos Silva 1646 (9). Matuda 337 (5); 1861 (12); 18416 (12). Maxon 196 (10). McDaniel 23263 (5). McVaugh 19104 (10). Medina 1190 (11). Meijer 51 (10). Melinon 25 (10). Mello Barreto 3019 (7). Melville 97 (6). Mereles 241 (9); 2188 (4); 2297 (6). Merrill 101 (1); 238 (1). Mexía 6331 (11); 8417 (11); 8482 (10); 10329 (4); 10811 (9). Meyer 74 (9); 145 (9); 374 (4); 760 (9); 2204 (9); 3322 (4); 5392 (9); 6430 (9); 11578 (9). Millán 568 (4). Molfino s.n. (4). Molina 15523 (6); 17944 (10); 26236 (5); 30696 (10). Mondolfi 33843 (10). Montaldo 3610 (11). Montes 110 (10); 111 (6); 372 (10); 715 (6); 741 (10); 748 (10); 1580 (10); 1587 (6); 1683 (10); 1756 (6); 1786 (10); 2201 (6); 2458 (10); 3381 (6); 7222 (10); 14834 (6); 15312 (10); 15335 (6); 15337 (6); 15348 (10); 16171 (10). Mora 2491 (6). Moran 5 (10). Morel 3438 (5). Moreno 248 (11); 849 (11); 973 (11); 9630

(6); 11361 (6); 11511 (6); 23441 (10); 24430 (6). Mori 10720 (10). Morong 977 (6); 1574 (5). Morton 3292 (10); 5216 (10). Mouret 18 (6). Mroginski 284 (10). Muñoz 14-48 (10). Múlgura 355 (4). Myers 5916 (5).

Nee 3638 (11); 17511 (11); 31529 (6). Neill 3745 (11); 6569 (10). Nelson 2660 (11); 2876 (10); 5190 (11); 7055 (6); 7327 (6); 7671 (6). Nicora 2995 (4); 3000 (6); 3006 (4); 3610 (9); 5296 (4); 6336 (4); 6532 (4); 8075 (4). Núñez 6589 (11).

Oldeman B-2225 (11); 2626 (10). Oldenburger ON-170 (10). Olga de Benavides 9214 (11). Oliveira 2792 (10). Opler 551A (10). Ordoñez 6 (6). Orozco 374 (10); 768 (10); 833 (10). Ortíz 1972 (10).

Pabon 308 (10); 687 (10). Palacios 135 (6); 137 (11); 138 (10). Palma 168 (6). Parodi 57 (4); 610 (4); 4191 (9); 4357 (9); 4466 (10); 4662b (6); 5448 (4); 5548 (10); 5606 (10); 7008 (4); 7099 (10); 8259 (6); 12590 (4). Partridge s.n. (4). Pavón 36 (11). Pedersen 928 (9); 3260 (6); 3715 (9). Pensiero 116 (6). Pereira 5505 (10); 7936 (9). Philcox 3670 (10); 8119 (6). Philipson 1638 (10). Pickel 107 (10); 1580 (10); 3276 (10); 5222 (7). Pinto 46 (6); 346 (11); 687 (5); 917 (10); 1522 (6); 1648 (10); s.n. (10). Pipoly 3578 (11); 8114 (10). Pire 341 (6). Pires 848 (10); 1662 (10); 1975 (5); 3515 (5); 6136 (10); 52092 (5). Pires Furtado 119 (9). Pittier 4092 (11); 8564 (11); 11082 (11). Plowman 8595 (10); 11568 (11). Pohl 9935 (11); 10017 (11); 10744 (10); 11024 (5); 11059 (6); 11254 (10); 11856 (6); 12054 (10); 12089 (11); 12094 (10); 12635 (10); 12818 (11); 12819 (6); 12911 (10); 12959 (6); 13154 (10); 13287 (11); 13351 (6). Portillo 47 (6). Pott 3010 (5); 3162 (5); 4117 (5). Prance 2859 (10); 4321 (10); 5228 (10); 5343 (11); 7168 (6); 7465 (11); 7703 (11); 20721 (10); 23298 (6). Proctor 16948 (10); 17083 (6); 17958 (10). Purpus 590 (5); 2160 (5); 7408 (11). Pursell 9094 (11).

Quarín 62 (6); 302 (9); 479 (10); 481 (4); 484 (10); 511 (4); 1590 (6); 1757 (6); 1761 (9); 1765 (6); 1801 (5); 1867 (9); 1948 (9); 2083 (6); 2440 (6); 2524 (9); 2850 (6); 3119 (5). Questel 503 (6); 4710 (6).

Rabelo 3094 (6); 3319 (10). Ragonese 3261 (4); s.n. (4). Rambo 38317 (4); 38765 (10); 39312 (4); 39336 (4); 41663 (10); 43850 (4); 44089 (4); 49217 (4); 53630 (9). Ramia 1213 (13); 1288 (13); 3630 (6). Ramírez 223 (4). Ramírez Reyes 1734 (6); 80-010 (6). Ramos 1597 (1); s.n. (1). Rangel 1430 (6). Reales 231 (5). Reed 713 (11); 716 (11). Reeder 5999 (6); 6008 (10); 6027 (6); 6101 (6). Regnell III-1364 (11). Reis 70 (11). Reitz 609 (11); 830 (4); 1782 (11); 9332 (4); 11868 (4); 14158 (4); 16460 (4); 17691 (4). Renvoize 2975 (4); 3287 (6); 3953 (6); 3956 (10); 4248 (11). Restrepo s.n. (6). Ribeiro 1725 (10). Riedel 101 (9); 1959 (11); s.n. (11); s.n. (3); s.n. (9). Rimachi 2471 (5); 7825 (6); 8014 (10). Robles 1701 (11). Rodríguez 116 (4); 834 (10); 3490 (5); 4424 (10); 4492 (6). Rojas 435 (6); 2326 (9); 9004 (9); 11209 (6); 14402 (10). Romanczuk 163 (10); 414 (9). Romero Castañeda 1044 (6); 6314 (10). Rondon 2493 (9). Rosengurtt 1676 (4); 5627 (4); 6470 (4); B-286 (4); B-828 (4); B-4956 (4); B-4957 (6); B-5351 (10); B-5555 (9); B-5938 (10). Roth 1323 (7). Rotman 60 (4). Rovirosa 625 (12).

Sacco 212 (4); 777 (4); 871 (4); 2500 (10). Sagot 692 (6); s.n. (5). Salguero 15 (6). Sampaio 1998 (11); 5918 (5); 6217 (4). Samuels 442 (10). Sandino 44 (11); 230 (11). Sandwith 673 (10); 1233 (6). Santos 714 (10). Sarmiento 1072 (6). Sastre 811 (11); 1058 (11); 2423 (10); 3086 (10); 3237 (10); 3847 (10). Schaffner 282 (5). Schiede s.n. (5). Schinini 4960 (4); 5703 (9); 5842 (10); 5851 (9); 5907 (6); 5914 (9); 5983 (10); 6675 (6); 6798 (9); 11534 (5); 13150 (6); 16074 (6); 16203 (9); 16245 (5); 16831 (6); 17265 (9); 17447 (6); 19325 (6); 23974 (9); 24029 (6); 25190 (9). Schipp 1372 (5). Schlumberger s.n. (10). Schmidt-Mumm 281 (11); 450 (6). Schomburgk 481 (10). Schott 4845 (3). Schultes 15248 (10); 15258 (10); 15605 (10); 15612 (10); 16109 (6); 19735 (6). Schulz 1796 (4); 3150 (6); 3191 (6); 3379 (5); 3394 (9); 3690 (9). Schunke Vigo 10661 (6); 10802 (6). Schwabe 692 (4). Schwacke 93 (11). Schwarz 1652 (10); 3972 (4); 4171 (9); 5769 (10); 6896 (10); 7140 (9); 7567 (9); 9630 (9); 11055 (9); 11075 (9); 11078 (11). Schwindt 28 (5); 828 (6); 4823 (10). Seibert 485 (11). Sellow s.n. (4). Semple 338 (6). Sendulsky 1069 (6); 1107 (10); 1771 (9); 1782 (11); 1819 (9); 1821 (9); 1824 (6). Sesmero 330 (9). Seymour 5295 (6). Shafer 174 (6); 3400 (6); 13505 (10); 13533 (10). Sieber 121 (11). Silva 257 (6); 271 (5); 298 (10); 339 (10); 1050 (6); 4116 (10); 4310 (10). Silverstone 876 (10). Sinclair 9828 (1). Skutch 5111 (10); 5208 (11). Skvortzov 90 (9). Smith 202 (6); 203 (10); 204 (6); 206 (11); 359 (10); 1251 (11); 1438 (6); 1747 (11); 2190 (11); 3523 (10); 6005 (10); 9132 (4); 10701 (7); 13997 (4); 14956 (10); 15475 (4); 15617 (6); 15723 (4). Snethlage 323 (10). Soderstrom 462 (5); 1027 (11); 1028 (10); 1111 (11); 1401 (11). Sohns 1449 (5). Soihet 200 (11). Solomon 9493 (11); 12901 (6); 12908 (11); 14775 (6); 16732 (5). Soria 960 (10). Soriano 1858 (4). Soto 28 (10). Soukup 3056 (10). Sousa s.n. (10). Sparre 898a (5); 942 (9); 1049 (11); 2229 (9). Spegazzini s.n. (10); s.n. (4); s.n. (5). Spruce 347 (5); 436 (5); 644 (10); Spruce Panicum 1 (10); 2 (10); 3 (10); 4 (10); 5 (6). Standley 8848 (11); 19824 (6); 23752 (11); 23861 (10); 24623 (5); 25995 (6); 26317 (10); 30998 (10); 53181 (11); 53529 (11); 54041 (10); 54473 (12); 62150 (10); 79566 (5); 87507 (12); 89612 (5). Staviski 738 (10). Stehle 1117 (6); 2077 (10). Steinbach 453 (6); 482 (10); 484 (11); 2134 (10); 5231 (11); 6840 (11). Stergios 4616 (10); 5984 (10). Stern 159 (10); 380 (10); 834 (6). Stevens 8079 (11); 13517 (10); 15305 (6); 17805 (6); 18850 (10); 19752 (10); 19943 (10); 22372 (6); 23717 (10); 25219* (10); 25275* (6); 25341* (10); 25354* (6). Steyermark 47887 (5); 49333 (5); 56148 (11); 72345 (11); 86997 (10); 101335 (11); 103711 (11); 113908 (10); 116468 (6); 118989 (11); 120340 (6); 122893 (11); 122969 (11); 123448 (11); 131246 (10); 131725 (6). Stockdale s.n. (11). St. Hilaire 77 (11); 154 (11); 388 (9); 595 (11); 623 (7); 1540 (9). Sucre 1943 (6); 2023 (10). Swallen 3197 (10); 3237 (10); 3292 (10); 3314 (10); 3311 (5); 3383 (10); 3532 (10); 3589 (10); 3595 (5); 3603 (10); 3625 (6); 4166 (6); 5109 (5); 7747 (4); 8126 (4); 8386 (9); 9550 (5); 9553 (5); 9585 (5).

Tamashiro 8 (10). Tamayo 3635 (10); 4124 (11). Tellez 3025 (10). Tenorio 1401 (10); 14541 (10). Thieme 5578 (11). Thomas 1491 (10). Thwaites 3242 (1). Torres 633 (10); 792 (11). Torres Flores 176 (11). Tracy 9062 (6). Tressens 2628 (9). Troncoso 2383 (4). Trujillo 14951 (10). Tutin 689 (6); G-69 (5).

Uribe 4054 (10); 4268 (11).

Valls 1037 (4); 1038 (4); 1791 (6); 1806 (10); 1897

(9); 2067 (10); 2077 (11); 2586 (10); 3077 (4); 4657 (4); 11644 (6). van der Werff 4900 (11); 5754 (11); 7521 (11). van Donseelar 2576 (6). van Hermann 763 (10). Vanni 69 (5); 72 (5); 378 (5). Vargas 16277 (6). Vásquez 788 (11); 3023 (6). Vautier 352 (10); 354 (10). Vázquez 1419 (6); 3023 (6). Vázquez Avila 323 (11); 436 (10). Velez 2716 (10). Venturi 1635 (6); 8127 (6). Vera 4080 (10). Vera Santos 2227 (10); 2655 (12). Vidal 952 (10). Viegas 5459 (10); s.n. (3). Villamil 4 (6). Vincelli 976 (6). von Sneidern 1022 (11); 4969 (11); 5064 (10); 5192 (11); A.1174 (10). von Tuerckheim 1254 (5); 1451 (10). von Wedel 1121 (11).

Wachencheim 235 (10). Warming s.n. (11). Wawra 234 (10); 285 (5). Weatherwax 1643 (11). Weddell 149 (5); 3142 (10). Whitefoord 87 (11); 411 (11); 1507 (10); 2753 (6). Widgren 904 (9). Wilbur 11629 (10). Williams 240 (11); 2575 (10); 4469 (11); 6740 (11); 7034 (11); 7404 (11); 7516 (11); 15982 (6); 18345 (11). Wilson 9444 (10); 9558 (13). Wingfield 5380 (11); 6227 (6); 6370 (11); 6855 (10). Wood 3642 (11). Woodson 1632 (6). Woolston G-48 (11); G-95 (11). Woronow 4453 (11). Wright 759 (6). Wullschaegel 623bis (6).

Young 284 (11). Yuncker 8203 (10).

Zambrano 1165 (11). Zardini 4263 (9); 7474 (4); 8187 (9). Zarucchi 4029 (10); 5586 (11). Zuloaga 73 (4); 438 (6); 593 (6); 623 (10); 624 (5); 657 (10); 744 (10); 808 (6); 864 (9); 1469 (6); 1878 (11); 1973 (10); 1994* (10); 2218* (5); 2235* (9); 2293 (5); 2298 (6); 2303 (10); 2337 (6); 2355 (10); 2371 (10); 2494* (9); 2571* (6); 3073* (4); 3087* (4); 3090 (6); 3170* (6); 3178 (6); 3177 (10); 3194* (10); 3197* (5); 3232* (9); 3251* (9); 3289* (10); 3290* (6); 3319* (6); 3323* (9); 3357 (4); 3868 (10); 3882 (10); 3913* (11); 3956 (11); 3983* (6); 4087* (11); 4181* (6); 4183* (6); 4238* (11); 4302 (6); 4313 (6); 4315* (5); 4330* (6); 4366 (10); 4367* (6); 4401 (6); 4513* (10); 4515 (11); s.n.* (9); s.n. (4).

A TREATMENT OF AMERICAN XYRIDACEAE EXCLUSIVE OF *XYRIS*[1]

Robert Kral[2]

ABSTRACT

This work is the first part of a treatment of New World Xyridaceae, exclusive of *Xyris*, and is focused on the other four genera that make up this family, namely *Abolboda* (21 species), *Achlyphila* (one species), *Aratitiyopea* (one species), and *Orectanthe* (two species). The treatment is conventional, providing (1) a general description, (2) a key to the genera, (3) detailed descriptions of each of the four genera and keys to their species where needed, and (4) illustrations of species and varieties together with synonymy and geographic distribution. Some realignment of taxa is presented. Two new species, *Abolboda dunstervillei* and *A. scabrida*, and one new variety, *Abolboda acaulis* var. *scaposa*, are proposed.

This treatment is directed toward a final reckoning of Xyridaceae for the New World and is based on studies commencing in the late 1950s, when my own interest in the family was confined to those of the southeastern United States, where *Xyris* is the only genus. At that time taxonomists considered the family to have two genera, *Abolboda* and *Xyris*, or followed the lead of Nakai (1943), who considered these to be monotypic in two families, Abolbodaceae and Xyridaceae, respectively. However, during that period and forward, extensive field exploration within the Neotropics resulted in discovery and description of many morphologies that escaped these traditional generic concepts. *Orectanthe* was described by Maguire (1958) as distinct from *Abolboda*, and shortly thereafter the monotypic *Achlyphila* Maguire & Wurdack was described (1960), the latter representing such morphological intermediacy between Abolbodaceae and Xyridaceae (Carlquist, 1960) as to convince most workers that the two families are indeed one. Finally, after this manuscript was being formed, Steyermark & Berry (1984) published yet a fifth genus, *Aratitiyopea*, based upon material previously described as a part of the bromeliaceous genus *Navia*. Thus, as this much revised manuscript is being done for what amounts probably to my last attempt, the Xyridaceae are thought by most to be comprised of five genera.

My objective is two-fold, first to present a synopsis of the four smaller taxa and second to present a synopsis of the much larger genus *Xyris*, in order ultimately to have something for all known New World species of Xyridaceae that would be similar to what was done for *Carex* in North America by K. K. Mackenzie (1931 et seq.). This first objective, a treatment of *Abolboda* (21 species), *Achlyphila* (one species), *Aratitiyopea* (one species), and *Orectanthe* (two species), will be a tight presentation. An all-inclusive description of the family will be followed by a key to all genera now known. Next, the treatment for each genus is presented, including (1) a full description of the genus, (2) a key to the species and varieties, (3) a full description of species and varieties, and (4) accompanying illustrations of all species and most varieties. Some discussion of the morphology peculiar to each of the four genera will be included under these genera, but this will be (and should be in such a synopsis) brief.

Lectotype designations are given here uniformly

[1] Many hundreds of specimens have been examined in the preparation of the work, and I acknowledge the assistance of curators and staffs of F, GH, K, L, MO, NY, P, U, and US who kindly made loans and facilities available. Particular thanks are due Otto Huber, ecologist and authority on tropical American savanna, and the late Julian A. Steyermark, outstanding authority on the Venezuelan flora, who provided both specimens and encouragement and without whom this work would have been impossible. Fieldwork in the Guayana Highlands was accomplished in part with the assistance of National Geographic and National Science Foundation funding: fieldwork in Brazil during 1988 was made possible through a travel grant from the National Geographic Society (National Geographic Society Travel and Research Grant #3471-86). Thanks are gratefully given to the editors of the *Annals of the Missouri Botanical Garden* for patience in seeing the editorial process through with equanimity. Likewise, I am very grateful to Grace Monty, technical secretary, Department of Biology, Vanderbilt University, for invaluable assistance in rendering script to the word processor.

[2] Herbarium, Box 1705, Station B, Vanderbilt University, Nashville, Tennessee 37235, U.S.A.

to represent work of all authors who, post-1935, applied instead the term "type" to such material. Therefore, none of these lectotype designations are mine; authors such as B. Maguire, Lyman B. Smith, etc., are the ones whose choice of material and places of deposit is followed, their intent being plain even if they did not use the term "lectotype."

Throughout the descriptions the terms coarse and fine, when referring to the plant as a whole, describe the plant's general aspect. Thus, coarse implies large and robust, while fine implies small and delicate.

I should stress here that I judge my efforts to be preliminary, even though they are based on field and herbarium work over more than 30 years. Real credit should go to the pioneers in neotropical botany whose extensive field and laboratory work have provided a proper basis for such a study as this. I refer particularly to Malme, L. B. Smith, Steyermark, Maguire, Wurdack, and Otto Huber, whose contributions have more than facilitated my own.

Xyridaceae Agardh, Aphor. Bot. 158. 1823. "Xyrideae," nom. cons.

Rosulate or caulescent, fine or coarse monocotyledonous, terrestrial (rarely aquatic) herbs, mostly of high-hydroperiod acidic soils. Roots mostly slender, diffuse-fibrous, with root hairs. Axis sympodial or monopodial. Leaves alternate, distichous or spiral, ligulate or eligulate, the bases broad, open-sheathing, frequently equitant and keeled, the blades laterally to dorsiventrally compressed, less often terete, angulate or variously channeled. Inflorescence lateral or terminal, scapose (rarely subsessile), the scapes of 1 to few from axils of scape sheaths or inner leaves, naked or with distant to approximate pairs of bracteal leaves, each scape bearing apically 1 or more imbricate-bracted spikes or heads or panicles of spikes. Flowers perfect, 1 to many, solitary and subsessile to pedicellate in axils of chaffy, leathery, or scarious bracts. Perianth in 2 differentiated whorls. Sepals (2–)3, the anterior (inner) one a reduced scale, or subequal to the others, or (*Xyris*) membranous and wrapped around the corolla, abscissing as the flower opens, the other 2 subopposite, connivent to basally connate, chaffy, mostly navicular, often keeled, persisting around the ripe capsule. Petals 3, equal or subequal, distinct to united and salverform or bilabiate, yellow to white, blue, lavender, or purple, mostly narrowed to connivent claws or to a narrow tube. Stamens 3, epipetalous; anthers tetrasporangiate, usually bilocular at anthesis, introrsely or laterally dehiscent, dehiscing longitudinally; pollen monosulcate or inaperturate. Staminodia (1–)3, scalelike, filamentous or bibrachiate and plumose, or lacking. Gynoecium 3-carpellate, the ovary 1-locular to completely or incompletely 3-locular, the placentation marginal, parietal, basal, free-central or axile (all conditions found in *Xyris*, in all other genera strictly axile); style terminal, distally tubular, slender, appendaged or exappendiculate, apically 3-branched or variously laminar, papillate, or fimbriate; stigmas 3. Fruit capsular, mostly loculicidal. Seeds usually numerous (rarely 1), mostly with strong longitudinal ridges and finer cross-lines, translucent or farinose-opaque, the embryo small, situated at base of an abundant mealy endosperm.

KEY TO THE GENERA OF AMERICAN XYRIDACEAE

1a. Petals gamopetalous; leaves polystichous; styles with appendages or ovary summit appendaged; pollen with spines or papillate; corolla regular or irregular; sepals 2–3.
  2a. Stylar appendages mostly well above style base on style; capsule apex thickened; flowers 1–several, the inflorescences sessile or on variously elongated, opposite-bracted scapes; sepals 2(–3) ..... *Abolboda*
  2b. Stylar appendages at or around style base; capsule apex not appreciably thickened; flowers many in dense globose or hemispheric large heads; sepals 3.
    3a. Corollas arching-spreading, irregular, yellow (rarely red-purple); stigma capitate, lateral-terminal, papillate; seeds winged, irregular ..... *Orectanthe*
    3b. Corollas erect, regular, salverform, purple; stigma terminal and trilobed, the lobes pilose; seeds wingless, ridged-and-pitted, symmetric ..... *Aratitiyopea*
1b. Petals usually distinct; leaves distichous, mostly equitant; styles unappendaged; pollen lacking spines or other protuberances; corolla regular; sepals 3.
  4a. Flowers distinctly pedicelled; sepals alike; staminodia lacking; style unbranched, the stigma capitate, trilobed ..... *Achlyphila*
  4b. Flowers subsessile; sepals not alike, the lateral ones chaffy and keeled, the inner one membranaceous and infolding the corolla bud; staminodia usually present, bibrachiate; style 3-branched, the stigmas "U"-shaped or annulate ..... *Xyris*

1. Abolboda Kunth in Humb. & Bonpl., Pl. Aequinoct. 2: 25, pl. 114. 1809.

Chloerum Willd. ex Link in Sprengel, Jahrb. 3, pt. 1: 74. 1833.

Poarchon C. Martius ex Seub. in C. Martius, Fl. Bras. 3, pt. 1: 223. 1855.

Coarse to low and mosslike (annual–)perennial, caulescent to essentially acaulescent, rosulate herbs